January 2004

REMEDIATION WORK PLAN
Voluntary Remediation Program

Former Karwick Road Landfill
Michigan City, Indiana
VRP Project #6020118

Prepared for:
City of Michigan City
Michigan City Economic Development Corp.
Two Cadence Park Plaza
Michigan City, Indiana 46360

Prepared by:

APT, LIMITED

6910 N. Main Street, Building #2/Unit #17
Granger, Indiana 46530

Project No. 312-01

APT, LIMITED

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U.S. EPA

February 26, 2004

Ms. Diane Spencer
Project Manager
Superfund Division
U.S. Environmental Protection Agency – Region 5
77 West Jackson Boulevard (SM-4J)
Chicago, Illinois 60604

Transmittal
Indiana VRP Remediation Work Plan
Former Karwick Road Landfill, Michigan City, Indiana
Indiana's Brownfields Assessment Demonstration Pilot
Assistance ID No. BP-97571501-0

Ms. Spencer:

APT, Limited (APT) has been retained by the City of Michigan City to provide environmental assessment services associated with a brownfield redevelopment project (Indiana's Brownfields Assessment Demonstration Pilot/Assistance ID No. BP-97571501-0).

Enclosed please find one copy of the *Indiana VRP Remediation Work Plan* (RWP) for the proposed completion sampling for the former Karwick Road Landfill site. This site investigation activities and proposed completion sampling described in the RWP and previously-submitted SAP (APT, April 2003) are in accordance with both the USEPA-approved multi-site QAPP and the requirements of the Indiana Voluntary Remediation Program. Completion sampling will not occur pending approval of the RWP by the IDEM; it is APT's understanding that the SAP has been approved by the USEPA. If you have any questions, please contact me at your convenience:

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Respectfully Submitted,

John E. Klanke, P.G.
Project Manager

Enclosure

Cc: Mr. Tony Rodriguez – Michigan City Economic Development Corp.;
Mr. Tom Stevenson – Environmental Incorporated

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1.0 EXECUTIVE SUMMARY

Michigan City Parks & Recreation Department (MCP&R) has entered Karwick Road Landfill Site (Karwick) in Michigan City, Indiana (see **Figure 1**) into the Indiana Voluntary Remediation Program (VRP) with the primary objective of obtaining a *Certificate of Completion* from the Indiana Department of Environmental Management (IDEM) and a *Covenant Not to Sue* from the State of Indiana Governor's Office. Application to the VRP was made in November 2001, and the site was accepted into the program in March 2002. APT, Limited (APT) has been retained by the Michigan City Economic Development Corporation (MCEDC) to implement the VRP with the purpose of assessing the redevelopment potential of Karwick under Michigan City's Brownfield Redevelopment Project entitled Revitalizing Environmentally Neglected Emerging Workplaces (RENEW). Michigan City subsequently applied for and was awarded funding through a USEPA Brownfield Pilot Grant to investigate the site.

A Phase I Environmental Assessment (EA) was performed by APT in March 2002, the results of which were presented in a *Phase I Environmental Assessment Report* (APT, Limited, March 2002). The results of the Phase I Environmental Site Assessment (ESA) identified two recognized environmental conditions (RECs), buried waste and site-wide groundwater.

This Phase I EA was followed by a Phase II EA, which investigated the RECs identified as a result of the Phase I EA. The site was entered into the VRP in January 2002, subsequent to the earliest site investigation activities. However, all Phase II site investigation activities have been conducted consistent with VRP guidance. The Phase II EA, which was conducted in several iterations from July 2001 through December 2003, is summarized in this report. Constituent concentrations for the constituents of concern (COCs) listed in **Table 1** are compared to their respective VRP Tier II criteria, or alternatively, to their Risk Integrated System of Closure (RISC) criteria if there is no published VRP Tier II criterion. The results of the Phase II EA follow:

- The media of concern at the former Karwick Road landfill are surface soils, subsurface soils, groundwater, and surface water and sediment in Trail Creek. The COCs are volatile organic compounds (VOCs); semivolatile organic compounds (SVOCs); and priority pollutant listed (PPL) metals (see **Table 1** for a listing of COCs and their proposed closure criteria);
- The Site consists of a former landfill that was created on the floodplain along the east bank of Trail Creek, and has an area of approximately 5.5 acres.[1]
- The geologic framework at the Site consists of eight to sixteen feet of debris and sand fill, underlain by a gray silt and clay unit. Saturated conditions indicative of the water table occur at depths of approximately 11 to 16 feet below ground surface, approximately coincident with encountering the gray silt and clay unit, and appear to be in hydraulic

[1] The City of Michigan City owns 23.5 contiguous acres of property, of which approximately 5.5 acres was utilized as a landfill. The landfill was created on the eastern floodplain of Trail Creek, which transects the 23.5 acre City property, with 18 acres being west of Trail Creek and 5.5 acres being east of Trail Creek. The 18-acre portion of the property west of Trail Creek is undisturbed, and consists of low-lying heavily wooded floodplain between Trail Creek and Cheney Run, the latter which forms the western boundary of the 23.5 acre City-owned land. Only the approximately 5.5-acre portion of the property east of Trail Creek (the Site) that was utilized as a landfill is the subject of this VRP project.

connection with the surface water in Trail Creek. The gray silt and clay unit extends to a depth of 45-47 feet below the ground surface, at which depth a confined sand and gravel aquifer unit is encountered. This sand and gravel unit extends to at least a depth of 75 feet below the ground surface, which represents the deepest borehole penetration at the site. These silt, clay, and sand/gravel units are part of the estimated 200 feet of unconsolidated glacial deposits overlying eroded Devonian and Mississippian age bedrock. The glacial deposits in the region are comprised of a basal clay-loam till unit containing zones of intertill sand and gravel covered by fine to medium glaciolacustrine and wind-blown sand with some beach gravel, local peat, and lake silt and clay deposits. The bedrock underlying the Michigan City location is the Antrim and Ellsworth shales (Devonian and Mississippian age);

- There was no evidence of impacted soils in any of the eight soil borings, except for soil boring GB-3. Four VOCs, methylene chloride, 1,3,5-trimethylbenzene (1,3,5-TMB), 1,2,4-trimethylbenzene (1,2,4-TMB), and xylenes, were detected in a soil sample collected from soil boring GB-3. The methylene chloride and 1,2,4-TMB concentrations exceed their respective default RISC Industrial criteria (there are no published VRP Tier II criteria);
- Several VOCs were detected in groundwater at six of the eight soil boring locations and seven of the eight monitoring well locations, at concentrations below applicable VRP Tier II Non-Residential/default RISC Industrial criteria (see **Table 1**);
- Several SVOCs were detected in groundwater at one of the eight soil boring locations and five of the eight monitoring well locations. However, all detected SVOCs were at concentrations below applicable VRP Tier II Non-Residential/default RISC Industrial criteria (see **Table 1**);
- Arsenic, cadmium, chromium, copper, lead, and mercury were detected in five groundwater screening samples, collected from soil borings during July 2001, at concentrations exceeding VRP Tier Non-Residential/default RISC Industrial criteria.
- Lead was detected at concentrations above the default RISC Industrial criterion of 42 μg/l in five groundwater samples collected during December 2001, from monitoring wells MW-2, MW-4, MW-6, MW-7, and MW-8;
- No metals were detected above VRP Tier II Non-Residential/default RISC Industrial criteria in groundwater samples re-collected during November 2003 using a low-flow sampling technique to reduce suspended solids;
- The groundwater samples collected from the eight soil borings during July 2001, and eight monitoring wells during December 2001 were noted to have a cloudy brown appearance, indicating the presence of sediment. The sediment present in these groundwater samples appears to be responsible for the elevated metals concentrations, given the results of the low-flow sampling event conducted in November 2003; and
- Surface water and sediment associated with Trail Creek, which flows northward along the western edge of the Site, do not exhibit environmental impacts. While there are no published sediment or surface water closure criteria, the measured constituent concentrations (VOCs, SVOCs, PPL metals, and polychlorinated biphenyls or PCBs) are below VRP Tier II Residential/default RISC Residential criteria.

There does not appear to be a significant risk of human exposure to target constituents at the Site. Access to the property is restricted. The grounds are secured within a barbed wire fence and large earthen berms. The principal potential exposure pathways are:

- Direct contact with or ingestion of potentially impacted soils by site visitors, trespassers, site workers or contractors;
- Direct contact with or ingestion of potentially impacted groundwater; and
- Direct contact with or ingestion of potentially impacted surface water and/or sediment associated with Trail Creek by site visitors, trespassers, site workers/contractors, or off-site receptors.

While two VOCs, methylene chloride, and 1,2,4-TMB, were detected at concentrations above default RISC Industrial criteria (there are no published VRP Tier II criteria) in a soil sample collected from boring GB-03, no remedial action is proposed with regard to subsurface soils anywhere at the Site. While there is analytical data for only a single subsurface soil sample, and no surface soil samples, field screening of soil cores collected continuously while drilling the sixteen soil borings and monitoring well boreholes indicated a general lack of impact.

No remedial action is proposed with regard to groundwater at the Site, although arsenic, cadmium, chromium, copper, lead, and mercury were detected in groundwater samples at concentrations exceeding applicable VRP Tier II Non-Residential or default RISC Industrial closure criteria. The elevated metals concentrations, which were measured in groundwater screening samples collected from eight soil borings in July 2001 and groundwater samples collected from eight monitoring wells in December 2001, appear to be the result of suspended sediment present in the samples. No metals were present at concentrations exceeding VRP Tier II Non-Residential/default RISC Industrial criteria in subsequent groundwater samples collected from the eight monitoring wells during November 2003 using a low flow sampling technique.

No remedial action is proposed with regard to surface water or sediment at the Site. No COCs were present at concentrations exceeding VRP Tier II Residential/default RISC Residential criteria in any sediment or surface water samples.

The MCEDC intends to obtain closure for approximately 5.5 acres of former floodplain east of Trail Creek that were historically utilized for landfilling purposes. The 18 acres of property west of Trail Creek, also owned by the City, has not ever been utilized for landfilling or other disposal, and appears to be undisturbed floodplain.

The VRP closure will utilize Non-Residential criteria for soils, Residential criteria for surface water and sediment associated with Trail Creek and Cheney Run, and Non-Residential criteria for groundwater. The constituents of concern are VOCs, SVOCs, and PPL metals in soil and groundwater; SVOCs, PPL metals, and PCBs in sediment; and VOCs and SVOCs in surface water.

An ERC will be recorded prohibiting the use of groundwater at the site; potable water in the area is supplied by the Michigan City Water Works, which derives their water supply solely from Lake Michigan. This approach will allow the MCEDC flexibility in redeveloping the site as a nature park.

2.0 INTRODUCTION

On behalf of MCEDC, APT has prepared this *Remediation Work Plan* (RWP) for the former Karwick Road Landfill, located on Karwick Road north of and near the intersection of Warnke Road in Michigan City, Indiana. Karwick was entered into the Indiana VRP for the purpose of obtaining a *Certificate of Completion* from the IDEM and a *Covenant Not to Sue* from the Indiana Governor's Office.

MCEDC will be seeking a *Certificate of Completion* and a *Covenant Not to Sue* for site-wide soils, site-wide groundwater, and surface water and sediment associated with Trail Creek and Cheney Run. The COCs are VOCs, SVOCs, and PPL metals in soil and groundwater; SVOCs, PPL metals, and PCBs in sediment; and VOCs and SVOCs in surface water. The COCs and proposed closure criteria are presented in **Table 1**.

The introduction section of this report consists of the following major sections:

- Site Background (2.1);
    - Site Location (2.1.1);
    - Site History (2.1.2); and
    - Site Documentation (2.1.3);
- Summary of Site Investigation Activities (2.2);
    - Phase I Environmental Assessment (2.2.1);
    - Phase II Environmental Assessment (2.2.2);
    - Baseline Ecological Assessment (2.2.3); and
    - Baseline Hydrogeological Assessment (2.2.4).

The remaining sections of the RWP present the Cleanup Criteria Selection (Section 3.0), Statement of Work (Section 4.0), Community Relations (Section 5.0), Future Use of Site (Section 6.0), Cost Estimate (Section 7.0), Remediation Plan (Section 8.0), Confirmation Sampling Plan (Section 9.0), Operation and Maintenance Plan (Section 10.0), and References (Section 11.0).

2.1 SITE BACKGROUND

This section contains a brief history of the facility along with documentation of the events leading up to the development of remedial solutions in accordance with the VRP.

2.1.1 Site Location

The former Karwick Road Landfill Site is located on Karwick Road near the intersection of Warnke Road and Karwick Road, in Michigan City, Indiana. The lat/long coordinates associated with the facility are 86° 51' 30"W 41° 42' 25"N; the UTM coordinates are 16 511945E 4617730N. The township/range coordinates for the facility are SE1/4 of SE1/4 SE ½ of Section 27, T38N, R4W. **Figure 1** is a portion of two United States Geological Survey 7.5 minute topographic maps (Michigan City East, Indiana Quadrangle 1980) showing the site location.

The Site consists of approximately 5.5 acres out of an approximately 23.5 acre property, and is that portion of the property that was formerly used as a landfill. The Site contains no buildings or structures, and is largely overgrown with weeds and small trees. Some portions of the Site contain large pieces of concrete rubble. Trail Creek, which separates an undisturbed 18-acre floodplain from the former 5.5-acre landfill, defines the western boundary of the Site. Cheney Run is west of Trail Creek and becomes confluent with Trail Creek approximately midway along the western boundary of the Site. The areas immediately adjacent to and west of Trail Creek are heavily wooded. Dirt trails run throughout the Site. A site map depicting a plan view of the entire 23.5-acre property and the 5.5-acre Site is shown on **Figure 2**.

The Site is located in a predominantly rural/residential area in Michigan City, LaPorte County, Indiana. The areas located immediately east of the Site are undeveloped and heavily wooded. The Chicago South Shore & South Bend Railroad and Chesapeake & Ohio Railroad (CSX) lines border the Site to the north and south. A third rail line, the Norfolk and Western Railroad, borders the southwest side of the 18-acre portion of the 23.5-acre property that is not the subject of this VRP project. An electrical substation is located northeast of the property, along the Chicago-South Shore rail line. The southeastern portion of the Site is bordered by a Northern Indiana Public Service Company right-of-way. A high-pressure gas line runs through the right-of-way to a transfer station located along the eastern side of Karwick Road. Residential properties are located south of the Site beyond the CSX rail line. The properties north of the Chicago-South Shore rail line and west of the Site are undeveloped wooded areas.

Electric power, natural gas, city water, and sanitary sewer services do not currently service the Site. However, city utilities do service the surrounding areas. According to city officials, no buildings have ever been present at the property and no utilities have ever been extended onto the Site.

2.1.2 Site History

No title information was provided to APT by MCP&R. Discussions with the Michigan City Engineer, Mr. Bill Phelps, indicate that the property has been owned by the city of Michigan City since the area was annexed in 1960. Prior to 1960, the Town of Lakeland owned the landfill. According to city officials, wastes accepted at the landfill were predominantly household wastes.

The Michigan City Economic Development Corporation (MCEDC) identified the site for potential redevelopment in 2000, under their Brownfield Redevelopment Project entitled Revitalizing Environmentally Neglected Emerging Workplaces (RENEW). Michigan City was subsequently awarded funding through a USEPA Brownfield Pilot Grant to investigate the site.

APT performed a Phase I ESA in 2002 associated with the purpose of assessing the redevelopment potential of the former Karwick Road landfill under Project RENEW. The results of this Phase I EA identified two RECs having potential environmental liability, buried waste and site-wide groundwater.

APT performed a Phase II EA in several iterations from July 2001 through November 2003, also associated with the purpose of assessing the redevelopment potential of the subject facility under Project RENEW, to investigate RECs identified in the Phase I EA report (APT, Limited, March 2002) as well as the potential for sediment and surface water impact to Trail Creek from the landfill. Subsurface soils and groundwater were analyzed for VOCs, SVOCs, and PPL metals. Sediment samples were analyzed for SVOCs, PPL metals, and PCBs. Surface water samples were analyzed for VOCs and SVOCs.

2.1.3 Site Documentation

Facility documentation available for review and used as a reference for preparing this RWP includes the following:

- *Geotechnical Exploration-Proposed Nature Park 2002* (Great Lakes, February 2001).
- *Voluntary Remediation Program Application* (APT, November 2001).
- *Phase I Environmental Assessment* (APT, March 2002).

2.2 SUMMARY OF SITE INVESTIGATION ACTIVITIES

As mentioned in the site history presented in Section 2.1.2 above, environmental site assessment activity at the Site has occurred in several phases, beginning in January 2001. Laboratory reports are attached as **Appendix A**, and bore logs (including those from the Great Lakes geotechnical testing) are found in **Appendix B**. Each of these phases of assessment activity are briefly identified below and described in more detail in Sections 2.2.1 through 2.2.3 of this document:

- In 2001, Great Lakes Engineering and Testing, Inc. performed a geotechnical investigation of the site to examine subsurface soils and recommend foundation and pavement design for a proposed park and nature center. Debris was discovered during the investigation. However, no evidence of environmental impacts was observed during the investigation. The boring locations from this investigation are shown on **Figure 2**.
- A Phase I EA performed by APT in January 2002. Recognized environmental concerns (RECs) were identified as having potential environmental liability;
- A Phase II EA performed by APT from July 2001 through December 2003, which investigated RECs identified in the Phase I, as well as surface water and sediment quality in Trail Creek. A total of eight groundwater screening samples were collected from eight soil borings (GB-1 through –8) in July 2001; eight monitoring wells (MW-1 through MW-8) were installed in December 2001, with two groundwater sampling and analyses events, in December 2001 and again in November 2003; ten sediment samples and ten surface water samples were collected from Trail Creek and Cheney Run (including four background sediment samples and four surface water samples from off-site upstream locations) in June 2003; and six surface water samples were collected from Trail Creek and Cheney Run during each of two sampling events, in September 2003 and December 2003. Soil was analyzed for VOCs; groundwater was analyzed for VOCs, SVOCs, and PPL metals; sediment was analyzed for SVOCs, PPL metals, and PCBs; and surface water was analyzed for VOCs and SVOCs. Soil boring, monitoring well, and surface water/sediment sampling locations are shown on **Figure 2.**

2.2.1 Geotechnical Investigation (Great Lakes Engineering and Testing, 2001)

Great Lakes Engineering and Testing (Great Lakes) conducted a geotechnical investigation of the site to examine subsurface soils and recommend foundation and pavement design for a proposed park and nature center. Debris was discovered during the investigation. No evidence of environmental impacts was observed during this investigation; however, the MCP&R retained APT to conduct an environmental site investigation.

2.2.2 Phase I Environmental Assessment (APT, March 2002)

APT conducted a Phase I EA in January 2002. A total of two RECs at the facility were identified as having the potential for environmental liability. The two RECs defined by APT were:

- REC-1: Buried Waste – The entire site was used as a municipal landfill. There is no available history of the types of waste accepted at the landfill. Information received from Michigan City personnel indicate that the landfill was used primarily to dispose of household waste and construction debris. However, partially buried drums observed at the time of the site walk-through indicate that all types of waste may have been received at the facility. Therefore, the buried waste represents a REC.
- REC-2: Site-Wide Groundwater Issues – Due to the dates of operations at the facility and lack of information regarding management practices, the possibility of buried chemicals and the resulting leachate, which may have affected the groundwater quality at the facility, cannot be mitigated. Therefore site-wide groundwater represents a REC.

2.2.3 Phase II Environmental Assessment (July 2001 through December 2003)

APT conducted a Phase II ESA at the site between July 2001 and December 2003. In July 2001, a total of eight soil borings were advanced at random, widely-spaced locations across the site using an Earthprobe™, a truck-mounted drilling unit, with attendant soil and groundwater screening sampling. In December 2001, eight monitoring wells were installed using a mobile drilling rig, with attendant groundwater sampling in December 2001 and again in November 2003. The monitoring wells were placed primarily along Trail Creek and along the upgradient (eastern) property boundary to define groundwater quality entering and leaving the Site, as well as to define the groundwater flow direction and gradient. Continuous soil coring was performed for geologic and chemical characterization while drilling all soil borings and monitoring wells. All laboratory analyses were performed by Pace Analytical Services, Inc. (Pace) in Indianapolis, Indiana.

The results of the Phase II EA indicated that :

- Three volatile COCs, methylene chloride, 1,3,5-TMB, and 1,2,4-TMB, were present in **subsurface soils** at concentrations exceeding default RISC Residential criteria (there were no published VRP Tier II criteria). Two of these constituents, methylene chloride and 1,2,4-TMB, were detected at concentrations exceeding default RISC Industrial criteria.
- No volatile or semivolatile COCs were present in groundwater at concentrations above VRP Tier II Non-Residential or default RISC Industrial criteria, as applicable (see **Table 1**), in any of the groundwater screening or investigative samples.
- Five **groundwater screening** samples, which were collected from soil borings GB-1, GB-2, GB-3, GB-6, and GB-8, exhibited arsenic, cadmium, chromium, copper, lead, and mercury concentrations above their respective VRP Tier II Non-Residential/default RISC Industrial criteria. However, these groundwater screening samples were noted to have a cloudy brown appearance, indicating the presence of sediment. The sediment present in the groundwater screening samples may be responsible for the elevated metals concentrations.

- No constituents are believed present in groundwater at the site at concentrations above VRP Tier II Non-Residential/default RISC Industrial criteria. Lead was detected above the RISC Industrial Default Closure criterion (0.042 mg/l) in the **investigative groundwater samples** collected in December 2001 from monitoring wells MW-2, MW-4, MW-6, MW-7, and MW-8 at concentrations ranging from 0.866 mg/L to 0.0515 mg/L. However, these groundwater samples were noted to have a cloudy brown appearance, indicating the presence of sediment, which was suspected as being responsible for the elevated lead concentrations, since metals are naturally occurring elements present in soils. Therefore, all five monitoring wells were re-sampled in November 2003 using a low-flow sampling technique to reduce the quantity of suspended solids in groundwater samples. Laboratory analysis of these November 2003 groundwater samples indicated that no constituents, including lead, are present in any of the samples at concentrations above VRP Tier II Non-Residential/default RISC Industrial criteria, as applicable.
- Groundwater flow is toward and apparently hydraulically connected to Trail Creek.

Each of the various phases of environmental assessment activity is described in more detail in the remainder of this section.

Soil and Groundwater Screening Sampling (July 2001)

Eight soil borings were advanced to the base of the landfill material, which ranged from a depth of 8 to 16 feet below the ground surface (BGS). The locations of the soil borings are shown on **Figure 2**.

One soil sample was collected for laboratory analysis, from a depth of eight feet BGS in boring GB-3, and analyzed for volatile organic compounds (VOCs) by Method 8260. The laboratory analytical report is included in **Appendix A**.

The analytical results for the soil sample collected from boring GB-3 are presented in **Figure 3** and **Table 2**. The volatile COCs methylene chloride, xylenes, 1,3,5-TMB, and 1,2,4-TMB were detected in the soil at concentrations of 39 mg/kg, 190 mg/kg, 66 mg/kg, and 730 mg/kg, respectively. Methylene chloride, 1,3,5-TMB, and 1,2,4-TMB, were present in **subsurface soils** at concentrations exceeding default RISC Residential criteria (there were no published VRP Tier II criteria). Methylene chloride and 1,2,4-TMB were detected at concentrations above their respective default RISC Industrial Closure Criteria (1.76597 mg/kg and 167.121 mg/kg, respectively); there are no VRP Tier II criteria for these constituents.

A single groundwater screening sample was collected from each soil boring and analyzed for VOCs, SVOCs, and PPL metals using SW-846 Methods 8260, 8270, and 6010/7471, respectively. No quality assurance/quality control (QA/QC) samples were collected during this phase of the assessment. The laboratory analytical report is included in **Appendix A**. The analytical results for the groundwater screening samples are presented in **Figure 4** and **Table 2**.

The analytical results for the groundwater screening samples are as follows:

- Seven volatile COCs, cis-1,2-dichloroethylene (cis-1,2-DCE), chlorobenzene, xylenes, 1,2,4-TMB, 1,4-dichlorobenzene (1,4-DCB), naphthalene, and 4-methyl-2-pentanone (MIBK) were detected in one or more of the groundwater screening samples. No VOC

COCs were detected in the samples collected from GB-5 (sample *GB-5;071101*) and GB-7 (sample *GB-7;071201*). None of the measured concentrations were above VRP Tier II Non-Residential/default RISC Industrial criteria.

- No semivolatile COCs were detected in the groundwater screening sample collected from soil boring GB-1, GB-3, GB-4, GB-5, GB-6, GB-7, and GB-8. Naphthalene, 2-methylnaphthalene, and bis(2-ethylhexyl)phthalate (DEHP) were detected in the groundwater screening sample collected from boring GB-2 (*GB-2;071101*). However, all measured concentrations were below VRP Tier II Non-Residential/default RISC Industrial criteria.

- The PPL metals barium, cadmium, chromium, copper, lead, nickel, and zinc were detected in one or more of the groundwater screening samples. Arsenic, cadmium, chromium, copper, lead, and mercury were all detected at concentrations above VRP Tier II Non-Residential/default RISC Industrial criteria. The remaining detected metals were all present at concentrations below VRP Non-Residential/default RISC Industrial criteria.

  - Arsenic was detected at concentrations exceeding its VRP Tier II Non-Residential criterion of 0.050 mg/L in groundwater screening samples collected from borings GB-2 and GB-3 (0.509 mg/L and 0.224 mg/L in samples *GB-2;071101* and *GB-3;071101*, respectively).

  - Cadmium was detected at a concentration exceeding its VRP Tier II Non-Residential criterion of 0.0511 mg/L in a groundwater screening sample collected from boring GB-2 (0.0794 mg/L in sample *GB-2;071101*).

  - Chromium was detected at a concentration exceeding its VRP Tier II Non-Residential criterion of 0.511 mg/L in a groundwater screening sample collected from boring GB-2 (1.05 mg/L in sample *GB-2;071101*).

  - Copper was detected at a concentration exceeding its default RISC Industrial criterion of 3.7814 mg/L (there is no published VRP Tier II criterion) in a groundwater screening sample collected from boring GB-2 (5.86 mg/L in sample *GB-2;071101*).

  - Lead was detected at concentrations exceeding its default RISC Industrial criterion of 0.042 mg/L (there is no published VRP Tier II criterion) in groundwater screening samples collected from borings GB-1, GB-2, GB-3, GB-6, and GB-8 (2.09 mg/L in *GB-1;071101*, 16.2 mg/L in *GB-2;071101*, 1.27 mg/L in *GB-3;071101*, 0.138 mg/L in *GB-6;071201*, and 0.311 mg/L in *GB-8;0712101*).

  - Mercury was detected at a concentration exceeding its VRP Tier II Non-Residential criterion of 0.0061 mg/L in a groundwater screening sample collected from boring GB-2 (0.0242 mg/L in sample *GB-2;071101*).

Monitoring Well Installation and Groundwater Sampling (December 2001)

Eight monitoring wells were installed using a mobile drilling rig equipped with hollow stem augers, and have total depths ranging from 13 to 19 feet BGS. The monitoring wells are of "stick up" design and each well was constructed using two inch diameter polyvinyl chloride (PVC) inner casing and screen materials, and a steel locking outer casing. All wells are screened across the uppermost water bearing strata. Bore logs for the installed monitoring wells are included in **Appendix B**.

Following the installation of the wells, a single groundwater sample was collected from each monitoring well on December 3, 2001 and analyzed for VOCs, SVOCs, and PPL metals using SW-846 Methods 8260, 8270, and 6010/7471, respectively. QA/QC samples were also collected and analyzed. One duplicate sample, one matrix spike/matrix spike duplicate (MS/MSD), and one trip blank were collected and analyzed for the same parameters as the investigative samples, with the exception of the trip blank, which was analyzed only for VOCs. The laboratory analytical report is included in **Appendix A**. The groundwater analytical results are presented in **Figure 5** and **Table 3**.

The December 2001 assessment activities yielded the following results:

- Volatile COCs were detected in seven of the eight groundwater samples; no VOCs were detected in the groundwater sample collected from monitoring well MW-1 (sample *MW-1;120301*). However, none of the reported concentrations exceeded VRP Tier II Non-Residential/default RISC Industrial criteria.
  - Chloroethane was detected in three samples (*MW-2;120301, MW-3;120301,* and *MW-4;120301*), at concentrations ranging from 0.0082 mg/L (sample *MW-2;*120301) to 1.60 mg/L (sample *MW-4;120301*). All concentrations were below the VRP Tier II criterion of 23.16075 mg/L.
  - 1,1-dichloroethane (1,1,-DCA) was detected in one sample (*MW-4;120301*), at a concentration of 0.13 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 10.22 mg/L.
  - Benzene was detected in three samples (*MW-2;120301, MW-3;120301,* and *MW-4;120301*), at concentrations ranging from 0.0053 mg/L (sample *MW-3;*120301) to 0.019 mg/L (sample *MW-4;120301*). All concentrations were below the VRP Tier II criterion of 0.0986 mg/L.
  - Toluene was detected in one sample (*MW-4;120301*), at a concentration of 0.090 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 20.44 mg/L.
  - Chlorobenzene was detected in six samples (*MW-2;120301, MW-3;120301, MW-4;120301, MW-5;120301, MW-6;120301,* and *MW-8;120301*), at concentrations ranging from 0.0067 mg/L (sample *MW-5;*120301) to 0.15 mg/L (sample *MW-8;120301*). All concentrations were below the default RISC Industrial criterion of 2.044 mg/L; there is no published VRP Tier II criterion.
  - Xylenes were detected in one sample (*MW-4;120301*), at a concentration of 0.010 mg/L total xylenes). This concentration is below its VRP Tier II Non-Residential criterion of 204.4 mg/L.
  - 1,2,4-TMB was detected in four samples (*MW-2;120301, MW-3;120301, MW-4;120301,* and *MW-8;120301*), at concentrations ranging from 0.0095 mg/L (sample *MW-3;*120301) to 0.042 mg/L (sample *MW-4;120301*). All

concentrations were below the default RISC Industrial criterion of 5.11 mg/L; there is no published VRP Tier II criterion.

- 1,3-dichlorobenzene (1,3-DCB) was detected in one sample (*MW-8;120301*), at a concentration of 0.0093 mg/L. This concentration is below its default RISC Industrial criterion of 0.09198 mg/L; there is no published VRP Tier II criterion.

- 1,4-DCB was detected in one sample (*MW-8;120301*), at a concentration of 0.011 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 0.1192 mg/L.

- Naphthalene was detected in three samples (*MW-4;120301, MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.0055 mg/L (sample *MW-7;*120301) to 0.073 mg/L (sample *MW-4;120301*). All concentrations were below the VRP Tier II Non-Residential criterion of 4.088 mg/L.

➢ Semivolatile COCs were detected in five of the eight groundwater samples; no SVOCs were detected in the groundwater samples collected from monitoring wells MW-1 (sample *MW-1;120301*), MW-3 (sample *MW-3;120301*), and MW-5 (sample *MW-5;120301*). However, none of the reported concentrations exceeded VRP Tier II Non-Residential/default RISC Industrial criteria.

- DEHP was detected in five samples (*MW-2;120301; MW-4;120301, MW-6;120301, MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.025 mg/L (sample *MW-7;*120301) to 0.044 mg/L (sample *MW-4;120301*). All concentrations were below the VRP Tier II Non-Residential criterion of 0.2043 mg/L.

- Naphthalene was detected in one sample (*MW-4;120301*), at a concentration of 0.043 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 4.088 mg/L.

➢ One or more PPL metals were detected in all eight groundwater samples. However, lead was the only COC detected at concentrations exceeding its VRP Tier II Non-Residential/default RISC Industrial criterion.

- Barium was detected in seven samples (*MW-2;120301, MW-3;120301, MW-4;120301, MW-5;120301, MW-6;120301, MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.241mg/L (sample *MW-2;*120301) to 0.710 mg/L (sample *MW-7;120301*). All concentrations were below the VRP Tier II Non-Residential criterion of 7.154 mg/L.

- Cadmium was detected in one sample (*MW-8;120301*), at a concentration of 0.011 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 0.0511 mg/L.

- Chromium was detected in four samples (*MW-4;120301, MW-6;120301 MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.0637 mg/L (sample *MW-6;*120301) to 0.155 mg/L (sample *MW-8;120301*). All concentrations were below the VRP Tier II Non-Residential criterion of 0.511 mg/L.

- Copper was detected in six samples (*MW-2;120301, MW-3;120301 MW-4;120301, MW-6;120301, MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.0213 mg/L (sample *MW-3*;120301) to 0.167 mg/L (sample *MW-7;120301*). All concentrations were below the default RISC Industrial criterion of 0.511 mg/L; there is no published VRP Tier II criterion.

- Lead was detected in seven samples (*MW-1;120301, MW2;120301, MW-3;120301 MW-4;120301, MW-6;120301, MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.0139 mg/L (sample *MW-1*;120301) to 0.866 mg/L (sample *MW-7;120301*). Five of the groundwater samples exhibited lead concentrations above default RISC Industrial criterion of 0.511 mg/L (there is no published VRP Tier II criterion): *MW-2;120301* (0.171 mg/L), *MW4;120301* (0.222 mg/L), *MW-6;120301* (0.0515 mg/L), *MW-7;120301* (0.866 mg/L), and *MW-8;120301* (0.279 mg/L).

- Nickel was detected in three samples (*MW-4;120301, MW-7;120301*, and *MW-8;120301*), at concentrations ranging from 0.060 mg/L (sample *MW-7*;120301) to 0.155 mg/L (sample *MW-8;120301*). All concentrations were below the VRP Tier II Non-Residential criterion of 2.044 mg/L.

- Zinc was detected in all eight samples, at concentrations ranging from 0.0508 mg/L (sample *MW-5;120301*) to 1.55 mg/L (sample *MW-7;120301*). All concentrations were below the VRP Tier II Non-Residential criterion of 30.66 mg/L.

- Mercury was detected in one sample (*MW-7;120301*), at a concentration of 0.00218 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 0.0061 mg/L.

The laboratory analytical report in **Appendix A** includes the analytical results of the QA/QC samples, including the groundwater duplicate sample (*DUP-1*), the groundwater MS/MSD samples, and trip blank.

A duplicate groundwater sample was collected from monitoring well MW-3 during the December 2001 sampling event (*DUP-1*). A comparison of the analytical results for the duplicate sample with the corresponding investigative samples is presented in **Table 4**. Laboratory precision is evaluated by calculating the relative percent difference (RPD) between the investigative and duplicate samples, using the formula:

$$RPD = \frac{\text{absolute}(X1-X2)}{(X1+X2)/2} \times 100$$

The calculated RPD values ranged from 0% to 116.7%. All of the calculated RPD values are within acceptable limits, with the exception of chlorobenzene (50.0%), 1,2,4-TMB (116.7%), and DEHP (82.4%). The relatively large RPD for chlorobenzene was likely due to the low measured concentrations for this constituent, wherein otherwise insignificant variations in concentration between the investigative sample and its duplicate are magnified. Similarly, the high RPD values for 1,2,4-TMB and DEHP is due to only being detected in one sample while not being detected in the other sample. In these cases, the RPD is calculated using half the detected limit as a surrogate concentration for the constituent that was not detected. This typically results in a high RPD. For

example, the laboratory reported a 1,2,4-TMB concentration of 0.0095 mg/l in the investigative sample *MW-3; 120301*. However, 1,2,4-TMB was not detected in the duplicate sample *DUP-1*. Therefore, 0.0025 mg/l (half the detection limit), was used as the surrogate concentration in the RPD calculation. This resulted in a calculated RPD value of 116.7%, which may not be reflective of actual differences between the two samples. In general, the December 2001 groundwater analytical results for the duplicate samples match their corresponding source sample and the resulting RPD values are acceptable.

The precision of the analytical results was also evaluated by comparing the percent recoveries of MS/MSD samples for groundwater (**Table 5**). With the exception of toluene, which had a 0% recovery in the MS sample, the percent recoveries in the groundwater MS/MSD sample were within acceptable ranges. According to Pace, the matrix spike recovery was affected by the sample matrix. However, it is likely that the laboratory technician neglected to spike the sample, as it is difficult to envision a zero percent recovery (short of total instrument failure), and the MSD spike recovery of 104% was within acceptable limits, thus indicating that the instrument was functioning. Furthermore, the laboratory control spike (LCS) recovery of 76% indicates that the system was within control. The calculated RPD values between the MS and MSD samples were all within acceptable ranges (see **Table 5**).

No VOCs were detected in the trip blank. These results indicate that sample handling and shipping procedures have not impacted the analytical results. Thus, the QA/QC sample analytical results indicate that the groundwater analytical results are valid and reliable for their intended use.

Baseline Surface Water and Sediment Sampling (June 2003)

APT mobilized to the Site in June 2003 to conduct baseline surface water and sediment sampling activities. A total of ten (10) surface water and ten (10) sediment samples were collected from Trail Creek and Cheney Run at the locations shown on **Figure 2** as follows:

- Four background surface water (designated 'BSW') and four background sediment (designated 'BSD') samples were collected, two each from upgradient, off-site areas of Trail Creek and Cheney Run, respectively;
- One surface water and one sediment sample were collected from Trail Creek at the upgradient property boundary of the site;
- One surface water and one sediment sample were collected from Cheney Run at the upgradient property boundary of the site;
- One surface water and one sediment sample were collected from Trail Creek just upstream of where Trail Creek and Cheney Run become confluent;
- One surface water and one sediment sample were collected from Trail Creek just downstream of where Trail Creek and Cheney Run become confluent;
- One surface water and one sediment sample were collected from Trail Creek, midway between where Trail Creek and Cheney Run become confluent and where Trail Creek exits the site; and
- One surface water and one sediment sample were collected from Trail Creek at the downgradient property boundary of the site.

The objective of the sampling and analysis was twofold: to determine whether site conditions had adversely impacted Trail Creek (via surface runoff and/or leaching of contaminants into the stream), and to assess whether there was a significant difference in stream quality (as evidenced by sediment and surface water) between the upstream and downstream boundaries of the Site. Sediment samples were analyzed for SVOCs, PPL Metals, and PCBs by SW-846 Methods 8270, 6010/7470, and 8082, respectively. Surface water samples were analyzed for VOCs and SVOCs by SW-846 Methods 8260 and 8270, receptively. QA/QC samples were also collected and analyzed. One duplicate sample and one matrix spike/matrix spike duplicate (MS/MSD) were collected for each matrix (sediment and surface water), and analyzed for the same parameters as the investigative samples. One trip blank, associated with the surface water samples, was analyzed for VOCs. The laboratory analytical report is included in **Appendix A**.

The baseline sediment sample analytical results are presented in **Figure 6** and **Table 6** and are as follows:

- No semivolatile COCs were detected in any of the background (off-site and upgradient) samples.
- One semivolatile COC, fluoranthene, was detected in an on-site sample (*SD-6;062303*) at a concentration of 5.4 mg/kg. This concentration is below its VRP Tier Residential criterion of 2,160 mg/kg.
- No metals were detected in any of the sediment samples at concentrations exceeding VRP Tier II Residential/default RISC Residential criteria.
    - Arsenic was detected in all four background samples and three of the on-site samples, at concentrations ranging from 2.0 mg/kg (sample *SD-3;062303*) to 4.97 mg/kg (sample *SD-1;062303*). All concentrations were below the VRP Tier II Residential criterion of 81 mg/kg.
    - Barium was detected in all of the sediment samples, at concentrations ranging from 9.06 mg/kg (sample *SD-5;062303*) to 61.5 mg/kg (sample *SD-2;062303*). All concentrations were below the VRP Tier II Residential criterion of 10,000 mg/kg.
    - Chromium was detected in all four background samples and five of the on-site samples, at concentrations ranging from 2.08 mg/kg (sample *SD-4;062303*) to 12.5 mg/kg (sample *BSD-3;062403*). All concentrations were below the VRP Tier II Residential criterion of 1,350 mg/kg.
    - Copper was detected in all four background samples and three of the on-site samples, at concentrations ranging from 2.18 mg/kg (sample *BSD-1;062403*) to 13.3 mg/kg (sample *BSD-3;062403*). All concentrations were below the default RISC Residential criterion of 580 mg/kg; there is no published VRP Tier II criterion.
    - Lead was detected in all four background samples and five of the on-site samples, at concentrations ranging from 1.79 mg/kg (sample *SD-4;062303*) to 45.7 mg/kg (sample *BSD-3;062403*). All concentrations were below the default RISC Residential criterion of 400 mg/kg; there is no published VRP Tier II criterion.

- ✦ Nickel was detected in all four background samples and five of the on-site samples, at concentrations ranging from 1.91 mg/kg (sample *SD-4;062303*) to 7.03 mg/kg (sample *BSD-2;062403*). All concentrations were below the VRP Tier II Residential criterion of 5,400 mg/kg.
- ✦ Zinc was detected in all four background samples and five of the on-site samples, at concentrations ranging from 11.5 mg/kg (sample *SD-4;062303*) to 97.8 mg/kg (sample *BSD-3;062403*). All concentrations were below the VRP Tier II Residential criterion of 10,000 mg/kg

- ➢ There was no apparent difference in the metals concentrations when comparing background and on-site samples.
- ➢ One PCB was detected, in background sample *BSD-4:062303*, at a concentration of 0.044 mg/kg. This is below the VRP Tier II Residential criterion of 0.08 mg/kg for <u>total</u> PCBs.

A duplicate sediment sample (*SDDUP-1)* was collected from sampling location SD-2 during the sampling event. A comparison of the analytical results for the duplicate sample with the corresponding investigative samples is presented in Table 7. The calculated RPD values ranged from 4.5% to 87.0%. All of the calculated RPD values are within acceptable limits, with the exception of lead (87.0%). The relatively large RPD for lead is due to only being detected in one sample while not being detected in the other sample. In these cases, the RPD is calculated using half the detected limit as a surrogate concentration for the constituent that was not detected. This typically results in a high RPD. For example, the laboratory reported a lead concentration of 2.49 mg/kg in the investigative sample *SD-2*. However, lead was not detected in the duplicate sample *SDDUP-1*. Therefore, 0.98 mg/kg (half the detection limit) was used as the surrogate concentration in the RPD calculation. This resulted in a calculated RPD value of 87.0%, which may not be reflective of actual differences between the two samples. In general, the June 2003 sediment sample analytical results for the duplicate samples match their corresponding source sample and the resulting RPD values are acceptable.

A MS/MSD sample was collected from sampling location SD-4 during the sampling event. The precision of the analytical results was also evaluated by comparing the percent recoveries of MS/MSD samples associated with the sediment sampling (**Table 8**). The percent recoveries in the June 2003 sediment MS/MSD sample were all within an acceptable range. The calculated RPD values between the MS and MSD samples ranged from 1% to 22%, and were all within acceptable limits (see **Table 8**).

Thus, the QA/QC sample analytical results indicate that the June 2003 sediment sample analytical results are valid and reliable for their intended use.

The baseline surface water analytical results are presented in **Table 9** and **Figure** 7 and are as follows:

- ➢ No volatile COCs were detected in any of the background (off-site and upgradient) samples.
- ➢ One VOC, carbon disulfide was detected in on-site surface water samples collected from sampling locations SW-1, SW-2, SW-3, SW-4, and SW-5 at concentrations of 0.0096 mg/L, 0.0096 mg/L, 0.010 mg/L, 0.013 mg/L, and 0.011 mg/L, respectively. No VOCs

were detected in the surface water sample collected from sampling location SW-6. While the carbon disulfide detections likely represent a laboratory artifact, none of the measured concentrations are above the default RISC Residential criterion of 1.3 mg/L; there is no published VRP Tier II criterion.

- No SVOCs were detected in any of the surface water samples.

A duplicate surface water sample (*SWDUP-1:062303)* was collected from sampling location SW-2 during the sampling event. A comparison of the analytical results for the duplicate sample with the corresponding investigative samples is presented in **Table 10**. The calculated RPD values for the two detected constituents were 30.1% (carbon disulfide) and 71.8% (methylene chloride). The calculated RPD value for carbon disulfide is within acceptable limits, but the RPD value for methylene chloride was outside the acceptable limit. The relatively large RPD for methylene chloride is due to only being detected in one sample while not being detected in the other sample. In these cases, the RPD is calculated using half the detected limit as a surrogate concentration for the constituent that was not detected. This typically results in a high RPD. The laboratory reported a methylene chloride concentration of 0.0053 mg/L in the duplicate sample *SWDUP-1:062303*. However, methylene chloride was not detected in the investigative sample *SW-2:062303*. Therefore, 0.0025 mg/L (half the detection limit) was used as the surrogate concentration in the RPD calculation. This resulted in a calculated RPD value of 71.8%, which may not be reflective of actual differences between the two samples. In summary, the June 2003 surface water sample analytical results for the duplicate samples match their corresponding source sample and the resulting RPD values are considered acceptable.

A MS/MSD sample was collected from sampling location SW-4 during the sampling event. The precision of the analytical results was also evaluated by comparing the percent recoveries of MS/MSD samples associated with the surface water sampling (**Table 11**). The percent recoveries in the June 2003 surface water MS/MSD sample were all within an acceptable range. The calculated RPD values between the MS and MSD samples ranged from 1% to 19%, and were all within acceptable limits (see **Table 11**).

Thus, the QA/QC sample analytical results indicate that the June 2003 surface water analytical results are valid and reliable for their intended use.

<u>Surface Water Monitoring (September 2003 and December 2003)</u>

APT mobilized to the Site in September and December 2003 to conduct surface water sampling activities. A total of six (6) surface water samples were collected from Trail Creek and Cheney Run during each of the sampling events at the locations shown on **Figure 2** as follows:

- One surface water sample was collected from Trail Creek at the upstream property boundary of the site;
- One surface water sample was collected from Cheney Run at the upstream property boundary of the 23.5-acre property of which the 5.5-acre Site is a part;
- One surface water sample was collected from Trail Creek just upstream of where Trail Creek and Cheney Run become confluent;

- One surface water sample was collected from Trail Creek just downstream of where Trail Creek and Cheney Run become confluent;
- One surface water sample was collected from Trail Creek, midway between where Trail Creek and Cheney Run become confluent and where Trail Creek exits the Site; and
- One surface water sample was collected from Trail Creek at the downstream property boundary of the Site.

These samples were collected at the same locations as the baseline samples collected in June 2003. The sampling locations had been marked with colored stakes. The objective of the sampling and analysis was to determine the degree of variation in surface water quality over time. Surface water samples were analyzed for VOCs and SVOCs by SW-846 Methods 8260 and 8270, receptively. The laboratory analytical report is included in **Appendix A**.

The surface water analytical results are presented in **Table 9** and **Figure 7** and are as follows:

- One VOC, acetone, was detected in the on-site surface water sample collected on September 16, 2003 from sampling location SW-4, at a concentration of 0.033 mg/L. While the acetone detection likely represents a laboratory artifact, the measured concentration is below its VRP Tier II Residential criterion of 3.04 mg/L. Acetone was not detected in the surface water sample collected from this same location on June 23, 2003 or December 23, 2003, nor was it detected in any of the samples collected from the remaining sampling locations.
- No VOCs were detected in the surface water samples collected on September 16, 2003 from the remaining five sampling locations.
- One VOC, toluene, was detected in the on-site surface water sample collected on December 23, 2003 from sampling location SW-1, at a concentration of 0.0083 mg/L. The measured toluene concentration is below its VRP Tier II Residential criterion of 1.0 mg/L. Toluene had not previously been detected in any of the surface water samples.
- No VOCs were detected in the surface water samples collected on December 23, 2003 from the remaining five sampling locations.
- No SVOCs were detected in any of the surface water samples collected during September and December 2003.

Duplicate surface water samples (*SWDUP-1;091603* and *SWDUP-1;122303*) were collected from sampling location SW-2 during the September 2003 and December 2003 surface water sampling events, respectively. A comparison of the analytical results for the duplicate sample with the corresponding investigative samples is presented in **Table 10**. No RPD values could be calculated for either of the sample pairs, as no constituents were detected in any of the investigative or duplicate samples. However, since the investigative/duplicate sample pairs did replicate one another, the September and December 2003 surface water sample analytical results are considered acceptable.

A MS/MSD sample was collected from sampling location SW-4 during each of the September and December 2003 surface water sampling events. The precision of the analytical results was also evaluated by comparing the percent recoveries of MS/MSD samples associated with the surface water sampling (**Table 11**). The percent recoveries in the September 2003 and December 2003 surface water MS/MSD samples were all within an acceptable range, except for toluene (54%) and chlorobenzene (42%) in the September 2003 MSD sample. The laboratory provided an explanation that the out-of-range recovery for these two constituents was due to matrix interference. However, the laboratory control spike (LCS) recovery of 109% for toluene and of 105% for chlorobenzene indicates that the system was within control. The calculated RPD values between the MS and MSD samples ranged from 4% to 57%, and were all within acceptable limits, except for trichloroethylene, toluene, and chlorobenzene in the September 2003 MS/MSD sample pair (see **Table 11**). This is the direct result of the poor recoveries for these constituents.

Based on the overall good surrogate recoveries and RPD values between the investigative sample/duplicate and MS/MSD pairs, as well as the good LCS recovery percentages, the QA/QC sample analytical results indicate that the September and December 2003 surface water analytical results are valid and reliable for their intended use.

Groundwater "Low Flow" Sampling (November 2003)

APT mobilized to the Site on November 11, 2003 to collect groundwater samples from all eight monitoring wells (MW-1 through MW-8). This sampling was conducted using a low flow sampling technique to minimize the amount of suspended sediment in samples. The purpose of the sampling was to test the hypothesis that the elevated metals concentrations measured in the July 2001 groundwater screening samples and December 2001 monitoring well samples were the result of suspended sediment and not reflective of actual groundwater quality. These groundwater samples were analyzed for VOCs, SVOCs, and PPL metals using Methods 8260, 8270, and 6010/7471, respectively.

The results of the November 2003 sampling and analyses (see **Table 3** and **Figure 5**) follow:

- Volatile COCs were detected in six of the eight groundwater samples; no VOCs were detected in the groundwater samples collected from monitoring well MW-5 (sample *MW-5;111003*) and MW-7 (*MW-7;111003*). However, none of the reported concentrations exceeded VRP Tier II Non-Residential/default RISC Industrial criteria.
    - Chloroethane was detected in one sample (*MW-4;111003*), at a concentration of 0.47 mg/L. This concentration is below its VRP Tier II criterion of 23.16075 mg/L.
    - Benzene was detected in two samples (*MW-3;111003* and *MW-4;111003*), at concentrations of 0.0054 mg/L and 0.015 mg/L, respectively. Both of these concentrations are below the VRP Tier II criterion of 0.0986 mg/L.
    - Trichloroethene (TCE) was detected in one sample (*MW-1;111003*), at a concentration of 0.0062 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 0.260 mg/L.
    - Chlorobenzene was detected in four samples (*MW-2;111003, MW-4;111003, MW-6;111003,* and *MW-8;111003)*, at concentrations ranging from 0.020 mg/L (sample *MW-4;*111003) to 0.095 mg/L (sample *MW-8;111003*). All concentrations are below the default RISC Industrial criterion of 2.044 mg/L; there is no published VRP Tier II criterion.

  - 1,2,4-TMB was detected in three samples (*MW-2;111003, MW-4;111003*, and *MW-8;111003*), at concentrations ranging from 0.006 mg/L (sample *MW-2;*111003) to 0.018 mg/L (sample *MW-8;111003*). All concentrations were below the default RISC Industrial criterion of 5.11 mg/L; there is no published VRP Tier II criterion.
  - 1,3,5-TMB was detected in two samples (*MW-2;111003* and *MW-4;111003*), at concentrations of 0.0053 mg/L and 0.011 mg/L, respectively. These concentrations are below the default RISC Industrial criterion of 5.11 mg/L; there is no published VRP Tier II criterion.
  - Naphthalene was detected in two samples (*MW-4;111003* and *MW-8;111003*), at concentrations of 0.060 mg/L and 0.013 mg/L, respectively. Both of these concentrations are below its VRP Tier II Non-Residential criterion of 4.088 mg/L.

- Semivolatile COCs were detected in three of the eight groundwater samples; no SVOCs were detected in the groundwater samples collected from monitoring wells MW-1 (sample *MW-1;111003*), MW-2 (sample *MW-2;111003*), MW-3 (sample *MW-3;111003*), MW-5 (sample *MW-5;111003*), and MW-7 (sample *MW-7;111003)*. None of the reported concentrations exceeded VRP Tier II Non-Residential/default RISC Industrial criteria.
  - DEHP was detected in one sample (*MW-6;111003*), at a concentration of 0.017 mg/L). This concentration is below its VRP Tier II Non-Residential criterion of 0.2043 mg/L.
  - 1,3-DCB was detected in one sample (*MW-8;111003*), at a concentration of 0.0092 mg/L). This concentration is below its default RISC Industrial criterion of 0.09198 mg/L; there is no published VRP Tier II criterion.
  - Naphthalene was detected in two samples (*MW-4;111003* and *MW-8;111003*), at concentrations of 0.035 mg/L and 0.0072 mg/L, respectively. Both of these concentrations are below its VRP Tier II Non-Residential criterion of 4.088 mg/L.

- One or more PPL metals were detected in three of the eight groundwater samples. No metals were detected at concentrations exceeding its VRP Tier II Non-Residential/default RISC Industrial criterion.
  - Arsenic was detected in one sample (*MW-5;111003*), at a concentration of 0.013 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 0.050 mg/L.
  - Lead was detected in one sample (*MW-4;111003*), at a concentration of 0.014 mg/L. This concentration is below its default RISC Industrial criterion of 0.042 mg/L; there is no published VRP Tier II criterion.
  - Selenium was detected in one sample (*MW-7;111003*), at a concentration of 0.0118 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 0.511 mg/L

- Zinc was detected in one sample (*MW-4;111003*), at a concentration of 0.0749 mg/L. This concentration is below its VRP Tier II Non-Residential criterion of 30.66 mg/L.

The November 2003 sampling and analyses results were consistent with the December 2001 sampling results with the exception of metals. There were only four metals detected in the November 2003 samples, none of which were detected at concentrations exceeding applicable VRP Tier II Non-Residential/default RISC Industrial criteria. This represents a significantly lower degree of impact compared to multiple metals detections including elevated lead concentrations in the December 2001 samples. The November 2003 low flow sampling results support the hypothesis that suspended sediment was responsible for the elevated lead detections in the previous sampling event. The November 2003 samples were much clearer, with little observable suspended sediment compared to the December 2001 samples.

The laboratory analytical report in **Appendix A** includes the analytical results of the QA/QC samples, including the groundwater duplicate sample (*DUP;111003*), the groundwater MS/MSD samples, and trip blank.

A duplicate groundwater sample was collected from monitoring well MW-5 during the November 2003 sampling event (*DUP;111003*). A comparison of the analytical results for the duplicate sample with the corresponding investigative samples is presented in **Table 4**.

Only one RPD value (88.9% for arsenic) could be calculated due to the predominance of non-detects. The relatively large RPD for this constituent was due to only being detected in one sample while not being detected in the other sample. In these cases, the RPD is calculated using half the detected limit as a surrogate concentration for the constituent that was not detected. This typically results in a high RPD. In this case, the laboratory reported an arsenic concentration of 0.013 mg/l in the investigative sample *MW-5;111003*. However, arsenic was not detected in the duplicate sample *DUP;111003*. Therefore, 0.005 mg/l (half the detection limit), was used as the surrogate concentration in the RPD calculation. This resulted in a calculated RPD value of 88.9%, which may not be reflective of actual differences between the two samples. In summary, the November 2003 groundwater analytical results for the duplicate samples match their corresponding source sample and the resulting RPD values are acceptable.

The precision of the analytical results was also evaluated by comparing the percent recoveries of MS/MSD samples for groundwater (**Table 5**). All of the percent recoveries in the groundwater MS/MSD samples were within acceptable ranges. The calculated RPD values between the MS and MSD samples ranged from 0% to 7%, and were also all within acceptable ranges (see **Table 5**).

No VOCs were detected in the trip blank. These results indicate that sample handling and shipping procedures have not impacted the analytical results. Thus, the QA/QC sample analytical results indicate that the groundwater analytical results are valid and reliable for their intended use.

2.2.4 Baseline Ecological Assessment

A baseline ecological assessment was conducted as part of the Phase II Investigation at the facility. The ecological assessment was conducted primarily as a desktop review and walk-through inspection to determine if critical habitats are present at the facility or if critical habitats could potentially be impacted by constituents associated with the facility. As such, potential exposure routes to sensitive areas and populations were examined.

Trail Creek forms the western boundary of the Site (the 5.5 acres of former landfill) and as such represents a sensitive environment with potential to be impacted by the Site. Numerous fish species are found in Trail Creek, and this stream discharges into Lake Michigan approximately 1.5 miles northwest of the Site.

In addition to a physical inspection (walk-through) of the facility and environs, APT conducted a search of the Indiana Department of Natural Resources (IDNR) files and U.S. Fish and Wildlife Service records regarding the areas surrounding the facility. These records include surface water quality, key aquatic and wildlife species, plant life, wetlands, and parks. The land use of the surrounding area, surface runoff, and topography of the immediate area was also researched.

A search of the Indiana Natural Heritage Data Center records for endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented was conducted for an area within a one-mile radius of the Karwick Road Landfill. The results of the search indicate the presence of two ETR species, the *Variegated Horsetail* (an endangered vegetative species) and *Shining Ladies'-Tresses* (a rare vegetative species) in the specified sections. However, none of the ETR species are believed present at the Site. The results of the Indiana Natural Heritage Data Center records search are included as **Appendix C** of this RWP.

The U.S. Fish and Wildlife Service records indicated that the area of interest is within the range of the federally endangered Indiana bat and the federally threatened bald eagle. The primary habitat of the Indiana bat is woodland areas, and the primary habitat of the bald eagle is in close proximity to lakes, rivers, or reservoirs. In addition to the above-mentioned species, there are several State-listed species found in the area including the lake sturgeon (in Lake Michigan) and peregrine falcons. Trail Creek also supports a significant salmonid resource and the harbor and beach areas toward the mouth of the creek are used by numerous migrating birds. None of the subject species have been observed at the site. The results of the U.S. Fish and Wildlife Service records search are included as **Appendix C** of this RWP.

No detrimental impact has been observed on vegetation or wildlife populations at the Site, and no potential future effects are anticipated, given the current site conditions. However, in order to assess whether the Site has adversely impacted Trail Creek, surface water and sediment sampling was performed as part of the Phase II EA, as described in Section 2.2.3 of this RWP. The result of this sampling and analysis program indicates that Trail Creek has not been adversely impacted by the Site.

2.2.5 Baseline Geological and Hydrogeological Assessment

A literature search was completed to provide a background understanding of the regional and local hydrogeology. The following applicable publications were reviewed:

- *Geologic Map of Indiana*; Indiana Geological Survey.
- *Hydrogeologic Atlas of Aquifers in Indiana*; U.S. Geologic Survey, 1994.

- *Soil Survey of LaPorte County, Indiana*; United States Department of Agriculture, Soil Conservation Service, 1974.
- *Foraker, Indiana 7.5-minute Topographic Quadrangle Map*; United States Geologic Survey, dated 1960, revised 1994.
- *Michigan City East, Indiana 7.5-minute Topographic Quadrangle Map*; United States Geologic Survey, dated 1980.
- *Water Resource Availability in the Lake Michigan Region, Indiana*; Indiana Department of Natural Resources, Division of Water, Water Resource Assessment 94-4.

Baseline Geological Assessment

According to the La Porte County, Indiana Soil Survey, the majority of the surface soil type at the Site is classified as Udorathents, loamy with Fluvaquents, loamy soil along Trial Creek and Oakville fine sand, 4% to 12% slopes along the C.S.S. & S.B. Rail Road tracks and Karwick Road. Udorathents soils consist of nearly level to steep soil and are on outwash plains, lake plains, till plains, and the moraine. Typical profiles of Udorathents, loamy soil consists of sandy loam or loam surface soil followed by underlying layers of loam, sandy loam, loamy sand, and some sandy clay loam and silty clay loam. This soil is often used for commercial building sites, burrow pits, interstate highway interchanges, and sanitary landfills. Fluvaquents, loamy soils are typically located on bottom land, is nearly level, and somewhat poorly drained. Typical profiles of Fluvaquents, loamy consist of a loam, silt loam, sandy loam, or loamy sand surface unit. This is followed by underlying layers of loam, sandy loam, loamy sand, sand, and sandy clay loam. Fluvaquents, loamy soils have moderate available water capacity and are moderately permeable. This soil is not used for growing crops, grasses and legumes or for building sites due to flooding and wetness limitations. However, Fluvaquents is suitable for woodlands. The Oakville fine sands soils are located on outwash plains, low sand dunes, and beach ridges. Typical profiles of Oakville fine grain soils consist of fine sands with thin bands of clayey and silty sands. The Oakville soils in this unit have low available water capacity and are highly permeable. The Oakville fine-grained soils are not typically used for growing crops. However this unit is suitable for woodland growth and limited residential development.

Karwick is located in the northern portion of the Lake Michigan Region within the Calumet Lacustrine Plain and Calumet Aquifer System (IDNR 1994). The Calumet Lacustrine Plain lies between the Valparaiso Morainal Area and Lake Michigan and has been altered as a result of industrialization and urbanization. The Calumet Lacustrine Plain was formed from the retreat of the Lake Michigan Lobe from its terminal position at the Lake Border Moraine and the development of ancestral Lake Michigan. From the existing land surface to the surface of the underlying bedrock, the Calumet Lacustrine Plain deposits are subdivided into three primary stratigraphic units: fine-grained lacustrine and dunal sands and medium-grained coastal sands; till and glaciolacustrine clay; and, stratified lacustrine sand, silt, and clay (IDNR, 1994). Additionally, slag and dunal sands were used to fill in depressions and lowlands to create a relatively featureless plain in the industrialized sections of the Calumet Lacustrine Plain and lakeshore areas.

Bedrock in the Lake Michigan Region consists of more than 4,000 feet of sedimentary rocks overlying a Pre-Cambrian basement. The uppermost bedrock units in the Lake Michigan Region range from Silurian to Mississippian Age. The bedrock underlying the Calumet Lacustrine Plain at the Site consists of Upper Devonian-age Antrim Shale. The Antrim Shale consists of brown to black non-calcareous shale; however, calcareous shale, limestone, and sandstone are present in the lower part of the unit in some areas of La Porte County (IDNR, 1994). According to regional geologic maps, the bedrock surface underlying the Site is at an elevation of approximately 425 feet above mean sea level (msl). Therefore, the unconsolidated Calumet Lacustrine Plain deposits at the Site are approximately 175 feet thick, based on an approximate surface elevation of 600 feet msl.

The site-specific geologic characterization as obtained from split-spoon samples collected during drilling activities at Karwick indicates that the geologic framework at the Site consists of eight to sixteen feet of debris and sand fill, underlain by a gray silt and clay native soil unit. The gray silt and clay unit extends to a depth of 45-47 feet below the ground surface, at which depth a confined sand and gravel aquifer unit is encountered. This sand and gravel unit extends to at least a depth of 75 feet below the ground surface, which represents the deepest borehole penetration at the site. These silt, clay, and sand/gravel units are part of the estimated 200 feet of unconsolidated glacial deposits overlying eroded Devonian and Mississippian age bedrock. The glacial deposits in the region are comprised of a basal clay-loam till unit containing zones of intertill sand and gravel covered by fine to medium glaciolacustrine and wind-blown sand with some beach gravel, local peat, and lake silt and clay deposits. The bedrock underlying the Michigan City location is the Antrim and Ellsworth shales (Devonian and Mississippian age). Bedrock was not encountered in any of the soil borings advanced on the subject property. Copies of soil boring logs for the drilling activities performed at Karwick are provided in **Appendix B**.

<u>Baseline Hydrogeological Assessment</u>

The nearest major surface waters to the Site are Lake Michigan to the north and Trail Creek to the south and west. Lake Michigan is located between 1¼ and 1½-miles north of the Site while Trail Creek defines the west boundary of the Site. Trail Creek is one of the few tributaries to Lake Michigan in the State of Indiana, which drains the northwestern part of La Porte County directly into Lake Michigan. Trail Creek flows in a northerly direction relative to the Site and empties into Lake Michigan. Lake Michigan serves as the potable water supply for the City of Michigan City, while Trail Creek is used for recreational fishing and boating.

The Site is located within the Calumet Aquifer System. The Calumet Aquifer System is mainly an unconfined aquifer bordered to the north by Lake Michigan and roughly to the south by the northern slopes of the Lake Border Moraine in northwestern LaPorte County. The Calumet Aquifer consists of fine to medium grained sands with dispersed lenses of beach gravel. Dunal sands cap the aquifer in many places and localized beds of laminated silt and clay and deposits of peat and muck confine the aquifer in small areas across the Lake Michigan Region. A relatively impermeable clay and till unit, that is greater than 100 feet thick in places, underlies the Calumet Aquifer. Static water levels in the Calumet Aquifer generally follow the trend of the surface topography. The depth to water in the area is typically less than 15 feet below the land surface. Regional hydrogeologic maps indicate that the regional groundwater flow direction of the Calumet Aquifer System is to the north-northwest towards Lake Michigan.

Development of the Calumet Aquifer has not been significant due to the proximity to Lake Michigan, which is an abundant source of potable water in the area. However, the Calumet

Aquifer is utilized as a source of water by a few domestic and small commercial facilities. The potable water supply from the Calumet Aquifer is typically derived from depths of 40 to 150 ft below the land surface. Domestic wells typically produce 5 to 20 gallons per minute (gpm) while high-capacity wells can expect to produce up to 100 gpm (IDNR, 1994). Higher sustained withdrawal rates are difficult to achieve in many areas due to the predominance of fine-grained sand.

Saturated conditions indicative of an unconfined water table were encountered while drilling at the Site, at depths ranging between approximately 11 and 16 ft below the ground surface, approximately coincident with encountering the gray silt and clay unit (see the bore logs in **Appendix B**), and appear to be in hydraulic connection with the surface water in Trail Creek. The monitoring wells installed by APT during the site investigation activities were screened to intersect the static water table.

Groundwater elevations were measured from the monitoring wells at the Site on December 3, 2001 and November 10, 2003. The depth to groundwater ranged between 11.12 and 15.95 feet below the tops of the inner well casings on December 3, 2001 and between 11.71 and 16.62 feet below the tops of the inner well casings on November 10, 2003 (**Table 12**). These groundwater elevation data were used to construct potentiometric surface maps that indicate the overall general shallow groundwater flow direction is to the west, toward Trail Creek (see **Figures 8a** and **8b**). The site hydrogeology as determined from the site investigation was consistent with literature descriptions for the area.

3.0 CLEANUP CRITERIA SELECTION

The cleanup criteria selected for the voluntary remediation of the former Karwick Road landfill are VRP Tier II Non-Residential Cleanup Goals/default RISC Industrial Closure Levels for soils and groundwater. Additionally, APT proposes that VRP Tier II Residential/default RISC Residential criteria be used to obtain closure on sediment and surface water in Trail Creek and Cheney Run. These cleanup goals will be applicable to all constituents of concern and all of the media of concern, as appropriate. Where VRP Tier II cleanup goals are not published, default RISC closure criteria for a residential (sediment and surface water) or non-residential (soils and groundwater) scenario will apply. The list of the COCs and their proposed cleanup goals are presented in **Table 1**.

Since VRP Tier II Non-Residential and default RISC Industrial criteria are being utilized for soils, a restrictive covenant limiting the future land use to non-residential purposes for the Site. Since VRP Tier II Non-Residential and default RISC Industrial cleanup goals are being utilized for groundwater, the MCEDC will record an ERC for the property prohibiting the use of groundwater in those portions of the site that are to be included in the *Certificate of Completion* and *Covenant Not to Sue*. Since the area is served by a municipal water supply derived from Lake Michigan, this will allow for site redevelopment for its intended purpose as a nature center. The specific portions of the site that are to be covered by the *Certificate of Completion* and *Covenant Not to Sue* will be surveyed by an Indiana licensed surveyor and shown on a scaled map that will be included in the *Completion Report*.

Since MCEDC is not formally proposing Tier III site-specific cleanup goals for any of the constituents of concern, a site-specific Risk Assessment is not warranted or applicable for this project. Should MCEDC propose the use of Tier III site-specific cleanup goals at a future time, a Risk Assessment will be performed in accordance with applicable guidance and an addendum to this RWP will be submitted to the IDEM.

4.0 STATEMENT OF WORK

No surface soil samples, and only one subsurface soil sample, were collected for laboratory analysis during the Phase II EA. While there were two constituents (methylene chloride and 1,2,4-TMB) detected in the subsurface soil sample at concentrations above default RISC Industrial Closure Levels (there are no published VRP Tier II criteria), there was a general lack of apparent impact site-wide based on field screening. Field screening using an OVM was performed on the soil cores continuously collected while drilling the eight soil borings and eight monitoring wells. Therefore, remedial action for subsurface soils at the site is not proposed at this time. Should the results of the completion sampling indicate that the Site is not eligible for closure, remedial alternatives will be evaluated.

Two rounds of groundwater sampling from the eight monitoring wells, supplemented by groundwater screening samples from eight soil borings, was performed during the Phase II EA. Arsenic, cadmium, chromium, copper, lead, and mercury were detected at concentrations exceeding VRP Tier II Non-Residential/default RISC Industrial criteria in the groundwater screening samples. Lead was detected above the VRP Non-residential cleanup criterion (0.015 mg/L) in the groundwater samples collected in December 2001 from monitoring wells MW-2, MW-3, MW-4, MW-6, MW-7, and MW-8 at a concentration of 0.171 mg/L, 0.0189 mg/L, 0.222 mg/L, 0.0515 mg/L, 0.866 mg/L, and 0.279 mg/L, respectively. The groundwater samples collected from these monitoring wells were noted to have a cloudy brown appearance, indicating the presence of sediment. The sediment present in the groundwater samples collected from monitoring wells was suspected of being the cause for the elevated metals concentrations. Therefore, a second round of groundwater sampling from the eight monitoring wells was performed in November 2003, using a low-flow sampling technique to reduce the amount of suspended sediment. The results of the November 2003 low-flow sampling indicated that no COCs were present in groundwater at concentrations exceeding VRP Tier II Non-Residential/default RISC Industrial criteria. Thus, remedial action with regard to groundwater is interpreted not to be necessary and is not proposed at the Site.

Baseline sediment sampling and three rounds of surface water sampling were performed in Trail Creek and Cheney Run. No COCs were detected at concentrations above residential land use criteria. Thus, remedial action with regard to surface water and sediment associated with Trail Creek is interpreted not to be necessary and is not proposed at the Site.

4.1 OBJECTIVES OF REMEDIAL ACTION

Remedial action is not proposed for any media anywhere at the Site. Completion sampling will be conducted for all areas that are to be included in the *Certificate of Completion* and *Covenant Not to Sue* to verify that constituent concentrations are below respective closure criteria.

Completion soil sampling will consist of an estimated 40 randomly selected soil borings. The Site was subdivided into four quadrants, with each quadrant gridded using 25-foot by 25-foot square grids. A random number table was then used to generate ten random sample coordinates for each quadrant. The locations of the proposed completion soil borings is shown on **Figure 9**.

Two soil samples, one surface and one subsurface soil sample, will be collected from each boring for laboratory analyses. The soil samples will be analyzed for VOCs, SVOCs, and PPL metals by SW-846 Methods 8260, 8270, and 6010/7470, respectively. All soil samples will be collected following the VRP DQOs for completion sampling (*i.e.*, Level 4 DQOs).

Completion groundwater sampling will consist of groundwater samples collected from all eight monitoring wells on a quarterly basis for four consecutive quarters. The eight existing on-site monitoring wells will be sampled using a low flow sampling technique, in order to verify previous sampling and analysis results. APT proposes that the November 2003 sampling event count as the first of the four completion sampling events, as VRP DQOs for completion sampling (*i.e.*, Level 4 DQOs) were followed for this sampling event. The groundwater samples will be analyzed for VOCs, SVOCs, and PPL metals by SW-846 Methods 8260, 8270, and 6010/7470, respectively. All groundwater samples will be collected following the VRP DQOs for completion sampling (*i.e.*, Level 4 DQOs).

A *Certificate of Completion* and *Covenant Not to Sue* is also being sought for sediment and surface water in Trail Creek and Cheney Run. Baseline surface water and sediment sampling, and two subsequent quarterly surface water sampling events, have already occurred (as described in Section 2.2.3 of this RWP). This sampling was all performed following the VRP DQOs for completion sampling (*i.e.*, Level 4 DQOs). APT proposes to perform an additional two surface water sampling events on a quarterly basis to supplement the already-completed sampling, with all of the data (existing and future) being used for the purpose of completion sampling. This data, which will span one year, will provide information regarding seasonal variations in surface water quality. The surface water samples will all be analyzed for VOCs and SVOCs by SW-846 Methods 8260 and 8270, respectively. All future surface water samples will also be collected following the VRP DQOs for completion sampling (*i.e.*, Level 4 DQOs).

Provided that the completion sampling verifies that applicable VRP Tier II/default RISC criteria are met, a *Completion Report* will be prepared and submitted to the IDEM, requesting a *Certificate of Completion* and *Covenant Not to Sue* with regard to the constituents of concern in the media of concern.

4.2 SITE SAFETY PLAN

A site-specific Health and Safety Plan (HASP) has been prepared and will be utilized during all activities being conducted at the site. All remediation work will be performed consistent with the training and other requirements of the Occupational Safety and Health Administration's (OSHA) hazardous waste site worker protection rules defined in 40 CFR 1910.120 as applicable. A copy of the HASP is included in this document as **Appendix D**.

4.3 QUALITY ASSURANCE PROJECT PLAN

A site-specific Quality Assurance Project Plan (QAPP) has been prepared for this project. The QAPP provides guidelines and procedures for sample collection and analysis such that the data collected during any supplemental investigations, quarterly progress sampling, and confirmation sampling following completion of remediation activities is representative, reliable, and of sufficient accuracy to support interpretations or conclusions regarding this site. The QAPP has been prepared per the VRP guidance detailed in the VRP Resource Guide (July 1996). A copy of the QAPP is included in this document as **Appendix E**.

5.0 COMMUNITY RELATIONS

The *Remediation Work Plan* is subject to a 30-day public notice and comment period. The *VRP Resource Guide* (IDEM, July 1996) specifies that a copy of the Remediation Work Plan will be placed in a local repository available for public review and comment. For this project, the proposed local repository is the Michigan City Public Library, located at 100 E. Fourth Street in Michigan City, Indiana. Phone: (219) 873-3044. This library is located approximately 2-1/4 miles west-southwest of the former Karwick Road landfill site. No community relations activities are planned other than the 30-day public comment period for the combined *Remediation Work Plan*. If a public hearing or other community relations activity is requested, the MCEDC will cooperate as necessary.

While there was only one subsurface soil sample collected, and there were two COCs detected at concentrations above applicable criteria, field screening of continuous soil cores collected from the eight soil bores and eight monitoring wells indicated a general lack of potential impact. Given the nature of the refuse placed in the landfill (supposedly household garbage and construction debris), remediation of soils will likely not be required. Characterization of the soil cores and exposed debris in the test pits dug by Great Lakes Engineering & Testing confirmed that the buried debris is consistent with household garbage.

The COC concentrations in groundwater are all below Tier II Non-Residential/RISC Industrial criteria, based on the most recent groundwater samples collected using a low-flow technique in November 2003. Thus, remediation of groundwater is also not likely to be required.

Since the Site will be used for non-residential purposes (i.e., a municipal nature park), VRP Tier II Non-Residential and default RISC Industrial criteria are appropriate for surface soils, subsurface soils, and groundwater at the site. An ERC will be filed restricting the future site utilization to non-residential uses, and prohibiting the use of on-site groundwater.

6.0 FUTURE USE OF SITE

The property will remain undeveloped for the immediate future. However, the long-term plan is to redevelop the Site into a municipal nature park.

7.0 COST ESTIMATE

The forward-going costs associated with obtaining the *Certificate of Completion* and *Covenant Not to Sue* for the Site are based on the following assumptions:

- No significant modifications to this RWP as a result of IDEM review or public comment.
- No actual remediation of soils or groundwater will be required; constituent concentrations in completion samples will be below VRP Tier II Non-Residential cleanup criteria.
- 80 completion soil samples; 40 surface soil samples and 40 subsurface soil samples.
- Eight days of drilling activity.
- Quarterly groundwater sampling over a one-year period.

An estimated breakdown of project costs on a forward-going basis is provided below:

Task	**Estimated Cost**
APT Project Management/Meetings with the IDEM/USEPA/Public Relations	$1,500
Addendum to USEPA-approved Sampling & Analysis Plan	$1,500
Completion Soil, Groundwater, and Surface Water Sampling	$103,650
Preparation and submittal of Completion Report to IDEM	$8,000
TOTAL	**$114,650**

8.0 REMEDIATION PLAN

This section of the RWP presents the remediation plan for the former Karwick Road landfill site, which includes the following:

- Summary of additional field investigations planned (Section 8.1); and
- Description of the recommended remedial alternative and other remedial alternatives considered (Section 8.2).

This section was developed in accordance with VRP guidance. The remediation plan presented in this section is subject to modifications, if determined to be necessary as the project progresses. Major modifications will be proposed to the IDEM for approval prior to their implementation.

8.1 ADDITIONAL FIELD INVESTIGATIONS

No additional field investigation activities are proposed.

8.2 REMEDIATION ALTERNATIVES

Since the results of the Phase II site investigation indicate that site remediation is not likely to be necessary, none is proposed. Should the completion sampling results indicate that the Site is not eligible for closure, remedial alternatives will be evaluated at that time.

9.0 CONFIRMATION SAMPLING PLAN

This section of the RWP describes the confirmation sampling plan for soils, groundwater, and surface water and sediment at the site, and includes:

- Sample Locations (Section 9.1);
- Sampling and Analytical Procedures (Section 9.2);
- Quality Assurance and Quality Control (Section 9.3); and
- Reporting (Section 9.4).

The IDEM VRP Section requires the collection of confirmatory samples before a *Certificate of Completion* is issued by the IDEM and a *Covenant Not to Sue* is issued by the State of Indiana's Governor's Office. The IDEM also requires that a VRP Section Project Manager and/or designee be present at the Site during sample collection to collect split samples for analysis by an independent laboratory.

To determine if cleanup goals have been met for surface and subsurface soils, a permissible exposure concentration (PEC) will be calculated for each COC based on a statistical analysis of soil analytical data (*i.e.*, 95% UCL of random soil sample analytical data). The calculated PECs will be compared to VRP Tier II Non-Residential/default RISC Industrial criteria, as applicable and as defined in **Table 1**, to demonstrate a lack of environmental or health risk.

To determine whether closure goals have been met for groundwater, surface water, and sediment, COC concentrations will be compared to VRP Tier II Non-Residential/default RISC Industrial (groundwater) or VRP Tier II Residential/default RISC Residential (surface water and sediment) criteria, as applicable and as defined in **Table 1.**

9.1 SAMPLE LOCATIONS

The sampling and analysis plan for the Site was developed to provide confirmation data for the purpose of obtaining closure under the VRP. As such, VRP Level IV DQOs will be used for all sampling and analysis activities, and the data thus obtained will be suitable for completion sampling purposes.

Completion soil sampling will consist of an estimated 40 randomly selected soil borings. The Site was subdivided into four quadrants, with each quadrant gridded using 25-foot by 25-foot square grids. A random number table was then used to generate ten random sample coordinates for each quadrant. Two soil samples, one surface sample and one subsurface soil sample, will be collected from each boring for laboratory analyses. The locations of the soil borings are shown in **Figure 9.**

Groundwater samples will be collected on a quarterly basis for four consecutive quarters from the eight monitoring wells (MW-1 through MW-8) installed at the Site (see **Figure 9**). These eight monitoring wells provide coverage across the entire site, including along the downgradient Site boundary

A *Certificate of Completion* and *Covenant Not to Sue* is also being sought for sediment and surface water in Trail Creek and Cheney Run. Baseline surface water and sediment sampling, and two subsequent quarterly surface water sampling events, have already occurred (as described in Section 2.2.3 of this RWP). This sampling was all performed following the VRP DQOs for completion sampling (*i.e.*, Level 4 DQOs). APT proposes to perform an additional two surface water sampling events on a quarterly basis to supplement the already-completed sampling, with all of the data (existing and future) being used for the purpose of completion sampling. This data, which will span one year, will provide information regarding seasonal variations in surface water quality.

Split sampling will be performed, with the IDEM representative choosing the number and locations of the split samples in the field.

9.2 SAMPLING AND ANALYTICAL PROCEDURES

All field and sampling activities will be done in accordance with the HASP provided in **Appendix D** and the QAPP provided in **Appendix E**.

Each of the 40 completion soil borings will be advanced to the water table, estimated to occur at depths between 8-16 feet below the ground surface. Continuous soil cores will be collected while drilling, and the retrieved cores will be field screened using a portable organic vapor meter (OVM) and geologically characterized. One surface sample and one subsurface soil sample will be collected from each boring. If there is evidence of impact in a boring, either through visual observations or organic vapor meter (OVM) readings, the subsurface soil sample will be collected from the interval exhibiting the greatest degree of impact. If there is no evidence of impact noted while drilling, the subsurface soil sample will be collected from just above the capillary fringe of the water table.

Given that the Site contains buried debris, a **mobile drilling rig** equipped with hollow stem augers may be required to advance the completion soil borings. The following procedure will be followed when sampling using this technique:

1. The drilling rig will be moved to the designated sampling location. Any deviation from the sample locations identified in this RWP, along with the reasons for changes of location, will be documented in the Field Logbook.
2. A decontaminated split-spoon sampler advanced to the desired depth following ASTM D-1586; each core will be taken with a vertical orientation. After being advanced to the sampling depth, the sampler will be withdrawn and the split-spoon sampler opened, exposing the soil core contained within for inspection.
3. The soil core will then be field screened for VOCs using an OVM equipped with a photoionization detector (PID). OVM measurements will be recorded in the logbook or on a Soil Boring Log form.
4. If warranted by gross indications of impact (OVM or visual), a soil sample will be collected for possible laboratory analysis.
5. The soil core will then be geologically characterized by the on-site geologist, in accordance with the procedure described in the QAPP (see **Appendix E**). The geologic

observations and stratigraphic information will be recorded in the logbook or on a Soil Boring Log form.

6. The above process will be repeated until the total boring depth is reached.

7. Two soil samples will be collected for laboratory analysis from each of the soil borings. A surface soil sample will be collected from a depth of approximately one foot below the ground surface. A subsurface soil sample will be collected from the interval exhibiting the greatest degree of potential impact based on field screening, or from just above the capillary fringe of the water table if no evidence of impact is noted while drilling.

8. Samples are to be analyzed for VOCs using SW-846 Method 8260; SVOCs using SW-846 Method 8270; and PPL metals using SW-846 Methods 6010 and 7471. Each soil sample will be transferred into the appropriate sample container by using a gloved hand and/or a decontaminated stainless steel spatula. A sample number will be assigned to that sample and all appropriate information will be recorded in the Field Logbook. If duplicate or matrix spike/matrix spike duplicate samples are required from a specified interval, the appropriate number of sample containers will be filled. Soil sample locations and intervals will be recorded in the Field Logbook or on a Soil Boring Log form using the appropriate sample identifier.

9. Following sampling activities, the chain-of-custody form will be completed and each sample container placed in an ice-filled cooler for storage. Each sample will be packaged and protected to reduce the potential for breakage and cross-contamination. Appropriate chain-of-custody procedures will be maintained. Sample labels are to be completed for each sample container as outlined in the QAPP (see **Appendix E**).

10. Following completion of each boring, the boring will be sealed with crushed-grade or granulated bentonite to the top of the borehole and potable water added to hydrate the bentonite.

If a **Geoprobe** (or similar type of push-probe technique) is used, the following procedure will be followed while advancing each borehole:

1. Push-probe equipment will be set up and the decontaminated macro-core sampler advanced to the desired depth using a hydraulic ram and hammer; each core will be taken with a vertical orientation. After being advanced to the sampling depth, the sampler will be withdrawn and the soil sample contained within the acetate liner will be removed from the sampler for inspection.

2. The soil core will be accessed by cutting open the acetate liner using a decontaminated liner cutter.

3. The soil core will then be field screened for VOCs using an OVM equipped with a photoionization detector (PID). OVM measurements will be recorded in the logbook or on a Soil Boring Log form.

4. If warranted by gross indications of impact (OVM or visual), a soil sample will be collected for possible laboratory analysis.

5. The soil core will then be geologically characterized by the on-site geologist, in accordance with the procedure described in the QAPP (see **Appendix E**). The geologic

observations and stratigraphic information will be recorded in the logbook or on a Soil Boring Log form.

6. The above process will be repeated until the total boring depth is reached.
7. Two soil samples will be collected for laboratory analysis from each of the soil borings. A surface soil sample will be collected from a depth of approximately one foot below the ground surface. A subsurface soil sample will be collected from the interval exhibiting the greatest degree of potential impact based on field screening, or from just above the capillary fringe of the water table if no evidence of impact is noted while drilling.
11. Samples are to be analyzed for VOCs using SW-846 Method 8260; SVOCs using SW-846 Method 8270; and PPL metals using SW-846 Methods 6010 and 7471. Each soil sample will be transferred into the appropriate sample container by using a gloved hand and/or a decontaminated stainless steel spatula. A sample number will be assigned to that sample and all appropriate information will be recorded in the Field Logbook. If duplicate or matrix spike/matrix spike duplicate samples are required from a specified interval, the appropriate number of sample containers will be filled. Soil sample locations and intervals will be recorded in the Field Logbook or on a Soil Boring Log form using the appropriate sample identifier.
12. Following sampling activities, the chain-of-custody form will be completed and each sample container placed in an ice-filled cooler for storage. Each sample will be packaged and protected to reduce the potential for breakage and cross-contamination. Appropriate chain-of-custody procedures will be maintained. Sample labels are to be completed for each sample container as outlined in the QAPP (see **Appendix E**).
8. Following completion of each boring, the boring will be sealed with crushed-grade or granulated bentonite to the top of the borehole and potable water added to hydrate the bentonite.

Soils and decontamination liquids generated during drilling activities will be placed in labeled 55-gallon drums for appropriate characterization and disposal as necessary.

The following procedure will be followed when collecting **groundwater completion samples** from monitoring wells:

1. The sampler will don new, clean, disposable, latex sampling gloves when performing sampling activities at each well location;
2. The depth to water will be measured in each monitoring well using an electronic water level indicator accurate to 0.01 feet.
3. Prior to collecting a groundwater sample from a monitoring well, standing groundwater in the monitoring well will be purged using a low flow technique to minimize agitation of the water column in the well. The pH, temperature, and specific conductivity of the groundwater will be periodically measured in the field. Purging of the monitoring well will be conducted until the following parameters are stabilized in accordance with the following criteria:
    - pH: ± 0.1 standard units;

- temperature: ± 0.5°C; and
- specific conductivity: ± 10 percent.

4. Purge water from the monitoring wells will be collected in 5-gallon buckets during purging and sampling. The purge water will be transferred to a properly designated and labeled 55-gallon drum for disposal at a later date;

5. Purging will be initiated by carefully installing the submersible pump in the well (to about the midpoint of the water column or slightly below), connecting the discharge tubing to the water quality meter, and starting the pump at the lowest possible flow rate (about 50 ml/min or so --- choking the downhole pump back with a valve at the well head). The pumping rate may be able to be increased to a maximum of approximately 100 ml/min or so, depending upon what the flow rate looks like. The flow rate will be verified using a graduated cylinder, flask, or equivalent. Drawdown in the well will be minimized, and should not exceed 5% of the standing water column in the well. The values of the target indicator parameters (pH, temperature, and specific conductivity) will be recorded as described above;

6. When purging is complete, and while the sampling pump is continuing to operate (still at a minimal rate --- 50 ml to 100 ml/min) water samples for laboratory analyses will be collected in the appropriate sample containers for the following analyses and in the following order:

   - VOCs;
   - SVOCs; and
   - PPL metals.

6. The collected groundwater will be decanted directly into laboratory supplied pre-preserved glass or plastic sample containers. The groundwater samples will be immediately placed into a pre-chilled sample cooler containing ice;

7. The groundwater sample to be analyzed for PPL metals will be decanted into a decontaminated plastic container and allowed to stand for several minutes and the clarified liquid carefully decanted (without disturbing the settled sediment) directly into a laboratory supplied pre-preserved plastic sample container. This will allow suspended sediment to settle, thus reducing the likelihood of "false positives" associated with detection of naturally occurring metals in suspended soil particles. The groundwater samples will be immediately placed into a pre-chilled sample cooler containing ice;

8. Following sampling activities, the chain-of-custody form will be completed and sample containers placed in an ice-filled cooler for storage. Samples will be packaged and protected to reduce the potential for breakage and cross-contamination. Appropriate chain-of-custody procedures will be maintained. Sample labels are to be completed for each sample container as outlined in Section 14. Groundwater samples will be analyzed for VOCs using SW-846 Method 8260; SVOCs using SW-846 Method 8270; and PPL metals using SW-846 Methods 6010 and 7471; and

9. Upon completion of the sampling activity at each well, the cap will be replaced and the well locked.

Samples will be stored at 4° C in the labeled sample containers supplied by the laboratory, and shipped to the laboratory using standard chain-of-custody procedures.

Surface water samples will be collected using the following procedure:

1. The sampler, wearing rubber hip waders, will don new, clean, disposable, latex sampling gloves when performing sampling activities at each location;
2. Using a dedicated 1-L amber glass sample bottle, the sampler will collect a surface water sample at each sampling location, making sure that the sample is collected from the upstream side of their body. The collected sample will be decanted directly into laboratory-supplied, pre-preserved 40-ml glass vials (VOC analysis) and 500-ml plastic (metals analysis) sample containers. The 1-L amber glass sample bottle will then be refilled and sealed for SVOC analysis; and
3. Following sampling activities, the chain-of-custody form will be completed and sample containers placed in an ice-filled cooler for storage. Samples will be packaged and protected to reduce the potential for breakage and cross-contamination. Appropriate chain-of-custody procedures will be maintained. Sample labels are to be completed for each sample container as outlined in Section 14. Surface water samples will be analyzed for VOCs using SW-846 Method 8260 and SVOCs using SW-846 Method 8270.

The sampling and analysis program is consistent with the project completion sampling guidance presented in the *Voluntary Remediation Program Resource Guide* (IDEM, July 1996). Laboratory analyses and reporting will be performed to satisfy Level 4 Data Quality Objectives (DQOs) defined by the IDEM VRP Section. The analytical methods and independent laboratory to perform the analyses of the split samples collected by the IDEM VRP Project Manager and/or designee will be chosen by the IDEM VRP Project Manager.

9.3 QUALITY ASSURANCE AND QUALITY CONTROL

The following quality assurance/quality control (QA/QC) samples will be collected as part of the completion soil sampling:

- Four duplicate surface soil samples and four duplicate subsurface soil samples;
- Four MS/MSD samples (two surface soil MS/MSD samples and two subsurface soil MS/MSD samples); and
- An estimated eight equipment rinsate blanks, one per day of soil sampling activity;

The following QA/QC samples will be collected as part of the completion groundwater sampling:

- One duplicate groundwater sample per quarterly sampling event;
- One MS/MSD sample per quarterly sampling event; and
- One trip blank per sample shipment.

Equipment rinsate blanks associated with the groundwater sampling are not needed, as dedicated, disposable polyethylene tubing will be used to collect groundwater samples.

The following QA/QC samples will be collected as part of the surface water sampling:

- One duplicate groundwater sample per quarterly sampling event;
- One MS/MSD sample per quarterly sampling event; and
- One trip blank per sample shipment.

There is no need of an equipment rinsate blank as dedicated, laboratory-supplied sample containers will be used to directly collect the surface water samples

The type and number of QA/QC samples that were collected was based on a several factors, including the number of investigative samples collected, the matrices investigated, the number of days to complete each sampling event, and achieving Level 4 DQOs defined by the IDEM VRP Section. The number of duplicate and matrix spike/matrix spike duplicate samples was based on a total of 40 surface and 40 subsurface soil samples in a single sampling event. The number of equipment rinsate samples was based on the soil sampling event taking a total of eight days to complete. The actual number of QA/QC samples will be dictated by the actual number of completion samples collected and the number of sampling days.

The VRP Resource Guide (IDEM, July 1996) indicates that: (1) field duplicates should be collected at the frequency of one per every ten samples, with a minimum of one sample per matrix per sampling event; (2) equipment rinsate blanks should be collected at the frequency of one for each day of sampling; and (3) MS/MSDs should be collected at the frequency of one per every twenty samples, with a minimum of one sample per matrix per sampling event.

The duplicate, MS/MSD, and equipment rinsate samples associated with the soil and groundwater sampling will be analyzed for the same constituents as the completion samples: VOCs by SW-846 Method 8260; SVOCs by SW-846 Method 8270; and PPL metals by SW-846 Method 6010 (Hg by SW-846 Method 7471). The duplicate and matrix spike/matrix spike duplicate samples associated with the surface water sampling will be analyzed for the same constituents as the completion samples: VOCs by SW-846 Method 8260 and SVOCs by SW-846 Method 8270. The trip blank samples associated with the groundwater and surface water sampling will be analyzed for VOCs by SW-846 Method 8260.

Additionally, the laboratory will perform internal QA/QC analyses. These analyses include standards blank analysis, equipment calibration verification, interference check samples, laboratory control samples, and method blanks.

9.4 REPORTING

The results of the completion sampling will be documented in a combined *VRP Completion Report*, which will summarize the sample locations, analytical results, and conclusions of the confirmation soil, groundwater, and surface water sampling. The Remediation Completion Report will be consistent with the requirements detailed in the VRP Resource Guide (July 1996), and will include the following elements:

- An INTRODUCTION (Section 1.0) including the site's name and address, a brief description of site operations, a brief discussion of the site history including the events which led to participation in the VRP.

- A REMEDIAL ACTION (Section 2.0) section providing: a brief summary of the remediation project, including major remedial activities undertaken; disposal of any generated wastes; remediation system details, including any significant problems encountered; a conceptual illustration of the system as installed; a list of major equipment used or installed; decontamination procedures to be used for dismantled equipment; a description of the operation and effectiveness of the remediation system; a description of the documentation procedures followed during the system operation; a description of confirmatory sampling procedures as actually implemented, including collection procedures, locations, results, and a comparison to cleanup goals; and a discussion of any site restoration activities.

10.0 OPERATION AND MAINTENANCE PLAN

This section presents a brief description of operation and maintenance activities required for the proposed remedial option, as required by VRP guidance. Since an active remediation system is not being proposed, operation and maintenance activities will consist of monitoring well inspections, and repairs as necessary.

The groundwater monitoring wells will be inspected during each groundwater sampling event for any signs of deterioration or other problems (e.g., rusted or broken locks, crumbling or cracked surface pad, missing well cap, standing water). Each well will be clearly labeled with a unique well identification to help eliminate misidentification of monitoring wells during sampling. The surveyed reference point will be maintained on the top of casing and clearly marked with indelible ink. Both the well label and the survey mark will be maintained throughout the monitoring program. The well inspection will include documentation of whether the well identification label and surveyed reference point on the well casing remain visible. The condition of each monitoring well will be documented in a Field Logbook.

Adjustments to the monitoring network, including but not limited to repair or replacement of wells, installation of additional wells (as warranted), will occur within 60 days following the end of a quarterly monitoring period. This will allow for a quarterly sampling to continue unabated.

11.0 REFERENCES

APT. November 2001. *Voluntary Remediation Program Application – Voluntary Remediation Program, Karwick Road Landfill Site.*

APT. March 2002. *Phase I Environmental Site Assessment Report – Voluntary Remediation Program, Karwick Road Landfill Site.*

United States Department of Agriculture – Soil Conservation Service. April 1982. *Soil Survey of Laporte County, Indiana.*

United States Geological Survey. 1994. *Hydrogeologic Atlas of Aquifers in Indiana.*

TABLES

Table 1 (Page 1 of 2)
Summary of Constituents and Closure Criteria for the Certificate of Completion and Covenant Not to Sue

Former Karwick Road Landfill
Michigan City, Indiana
VRP Site Identification No. 6020118

Constituent	VRP Tier II Non-Residential Surface Soil Criteria [1,2] (mg/kg)	VRP Tier II Non-Residential Subsurface Soil Criteria [1,2] (mg/kg)	Default RISC Industrial Soil Criteria [1,3] (mg/kg)	VRP Tier II Non-Residential Groundwater Criteria [1,2] (mg/L)	Default RISC Industrial Groundwater Criteria [1,3] (mg/L)
Metals, ICP, Trace Prep/Method: EPA 3010 / EPA 6010					
Antimony	816	584	36.9555	0.06	0.04088
Arsenic	612	438	19.5561	0.05	0.05
Barium	10,000	10,000	5,894.9	7.154	7.154
Beryllium	13.49	118.6	2,265.98	0.005	0.2044
Cadmium	1,020	730	76.8544	0.0511	0.0511
Chromium III	10,000	10,000	10,000	102.2	153.3
Chromium VI	10,000	7,300	117.734	0.511	0.3066
Copper	NA	NA	1,694.07	NA	3.7814
Lead	NA	NA	230	NA	0.042
Nickel	10,000	10,000	2,665.38	2.044	2.044
Selenium	10,000	7,300	53.144	0.511	0.511
Silver	10,000	7,300	86.87	0.511	0.511
Thallium	NA	NA	13.098	NA	0.009198
Zinc	10,000	10,000	10,000	30.66	30.66
Mercury	122.4	87.6	32.0337	0.0061	0.03066
Semivolatile Organics Prep/Method: EPA 3510 / EPA 8270					
Phenol	10,000	658.78	315.922	12.264	61.32
bis(2-Chloroethyl) ether	4.06	0.66	0.01202	0.01	0.002601
2-Chlorophenol	10,000	11.63	9.98933	0.511	0.511
1,3-Dichlorobenzene	NA	NA	1.78722	NA	0.09198
1,4-Dichlorobenzene	2,416.67	34.67	3.44083	0.1192	0.119233
Benzyl alcohol	10,000	4,356.75	135.15	30.66	30.66
1,2-Dichlorobenzene	10,000	10,000	265.079	9.198	9.198
2-Methylphenol (o-Cresol)	10,000	375.93	39.0817	5.11	5.11
bis(2-Chloroisopropyl) ether	93.12	1.32	0.2636	0.0409	0.04088
3-Methylphenol	NA	NA	30.2106	NA	5.11
4-Methylphenol	10,000	427.24	2.98631	5.11	0.511
N-Nitroso-di-n-propylamine	8.29	0.66	0.00203	0.01	0.000409
Hexachloroethane	408	3.31	7.71447	0.0204	0.1022
Nitrobenzene	1,020	1.73	0.33653	0.0511	0.0511
Isophorone	10,000	256.03	17.6892	3.0105	3.012211
2,4-Dimethylphenol	NA	NA	25.2641	NA	2.044
Benzoic acid	10,000	10,000	1,645.06	408.8	408.8
2,4-Dichlorophenol	6,120	15.12	3.02928	0.3066	0.3066
1,2,4-Trichlorobenzene	10,000	1,405.37	76.9607	1.022	1.022
Naphthalene	10,000	10,000	171.768	4.088	2.044
4-Chloroaniline	8,160	1,117.69	NA	0.4088	NA
Hexachloro-1,3-butadiene (a.k.a. Hexachlorobutadience)	1.78	31.18	43.9991	0.0367	0.02044
2-Methylnaphthalene	NA	NA	208.89	NA	2.044
Hexachlorocyclopentadiene	2.02	2.89	2,000	0.7154	0.7154
2,4,6-Trichlorophenol	1,922.89	30.65	5.00535	0.26	0.260145
2,4,5-Trichlorophenol	10,000	5,507.44	694.963	10.22	10.22
2-Chloronaphthalene	10,000	10,000	0.02666	8.176	0.000392
2-Nitroaniline	42.9	3.3	0.02941	0.05	0.005825
Dimethylphthalate	10,000	10,000	1,394.94	1,022	1,022
Acenaphthene	10,000	10,000	1,217.78	6.132	4.24
2,4-Dinitrophenol	4,080.0	7.37	0.81769	0.2044	0.2044
2,4-Dinitrotoluene	4,080.0	39.07	NA	0.2044	NA
Diethylphthalate	10,000.0	10,000	1,268.92	81.76	81.76
Fluorene	10,000.0	10,000	1,100.89	4.088	1.98
N-Nitrosodiphenylamine	10,000.0	567.8	32.4706	0.5837	0.584
Hexachlorobenzene	6.87	101.56	3.94203	0.01	0.001789
Pentachlorophenol	483.33	24.95	0.66008	0.05	0.023847
Anthracene	10,000	10,000	51.3858	30.66	0.0434
Di-n-butylphthalate	10,000	6,188.56	2,000	2.044	10.22
Fluoranthene	10,000	10,000	882.504	0.8176	0.206
Pyrene	10,000	10,000	567.54	3.066	0.135
Butylbenzylphthalate	10,000	10,000	928.319	20.44	2.69
3,3-Dichlorobenzidine	128.89	12.86	0.2096	0.02	0.006359
Benzo(a)anthracene	79.45	103.88	15.3481	0.01	0.00392
Chrysene	7,945.21	10,000	25.4784	0.3918	0.0016
bis(2-Ethylhexyl)phthalate	4,142.86	1,406.25	982.621	0.2043	0.2044
Di-n-octylphthalate	10,000	10,000	2,000	2.044	0.02
Benzo(b)fluoranthene	79.45	354.98	15.3481	0.01	0.0015
Benzo(k)fluoranthene	794.52	3,759.12	39.3632	0.0392	0.0008
Benzo(a)pyrene	7.94	69.85	1.53481	0.01	0.000392
Indeno(1,2,3-cd)pyrene	79.45	629.17	3.05369	0.01	0.000022
Dibenzo(a,h)anthracene	7.95	69.86	1.53481	0.01	0.000392

Notes:
1. The cleanup goals that will be used are indicated in boldface type. NA = No VRP or RISC value available.
2. VRP cleanup goals are from Voluntary Remediation Program Resource Guide (IDEM, July 1996).
3. RISC closure values are from Risk Integrated System of Closure Technical Resource Guidance Document (IDEM, August 2003).
4. The VRP Tier II groundwater criterion for chloroethane represents the VRP Tier II Residential criterion; there is no published VRP Tier II Non-Residential criterion.

Table 1 (Page 2 of 2)
Summary of Constituents and Closure Criteria for the Certificate of Completion and Covenant Not to Sue

Former Karwick Road Landfill
Michigan City, Indiana
VRP Site Identification No. 6020118

Constituent	VRP Tier II Non-Residential Surface Soil Criteria[1,2] (mg/kg)	VRP Tier II Non-Residential Subsurface Soil Criteria[1,2] (mg/kg)	Default RISC Industrial Soil Criteria[1,3] (mg/kg)	VRP Tier II Non-Residential Groundwater Criteria[1,2] (mg/L)	Default RISC Industrial Groundwater Criteria[1,3] (mg/L)
GC/MS VOCs Method: EPA 8260					
Vinyl chloride	**0.02**	**0.13**	0.01345	**0.01**	0.002
Chloroethane[4]	**1,000**	**1,000**	5.18956	**23.16075**	0.986759
Methylene chloride	NA	NA	**1.76597**	NA	**0.381547**
1,1-Dichloroethene	**0.15**	**0.08**	42.2481	**0.007**	5.11
trans-1,2-Dichloroethene	NA	NA	**13.8744**	NA	**2.044**
1,1-Dichloroethane	**973.47**	**1,000**	57.9978	**10.22**	10.22
cis-1,2-Dichloroethene	**1,000**	**102.49**	5.84418	**1.022**	1.022
Chloroform	**5.28**	**20.33**	1.15713	**0.4689**	0.469115
1,1,1-Trichloroethane	**1,000**	**1,000**	34.5524	**9.198**	3.577
Carbon tetrachloride	NA	NA	**0.29042**	NA	**0.022012**
Benzene	**16.63**	**4.77**	0.66738	**0.0986**	0.098676
1,2-Dichloroethane	**5.27**	**0.37**	0.14992	**0.0314**	0.031446
Trichloroethene	**24.97**	**25.73**	2.96409	**0.26**	0.260145
1,2-Dichloropropane	NA	NA	**0.25054**	NA	**0.042082**
Bromodichloromethane	NA	NA	**0.63172**	NA	**0.1**
Toluene	**1,000**	**1,000**	240.496	**20.44**	20.44
1,1,2-Trichloroethane	**22.74**	**1.05**	0.30478	**0.0502**	0.050204
Tetrachloroethene	**101.23**	**8.01**	0.63545	**0.0561**	0.055031
Chlorobenzene	NA	NA	26.6365	NA	**2.044**
1,1,1,2-Tetrachloroethane	**75.91**	**7.24**	0.79522	**0.11**	0.110062
Ethylbenzene	**1000**	**1000**	195.172	**10.22**	10.22
Styrene	NA	NA	**720.344**	NA	**20.44**
Bromoform	NA	NA	**2.72509**	NA	**0.362228**
1,1,2,2-Tetrachloroethane	**75.41**	**0.21**	0.11099	**0.0143**	0.014308
1,3,5-Trimethylbenzene	NA	NA	**68.8474**	NA	**5.11**
1,2,4-Trimethylbenzene	NA	NA	**167.121**	NA	**5.11**
1,3-Dichlorobenzene	NA	NA	**1.78722**	NA	**0.09198**
1,4-Dichlorobenzene	**2,416.67**	**34.67**	3.44083	**0.1192**	0.119233
1,2-Dichlorobenzene	**10,000**	**10,000**	265.079	**9.198**	9.198
1,2,4-Trichlorobenzene	**10,000**	**1,405.37**	76.9607	**1.022**	1.022
Hexachloro-1,3-butadiene	NA	NA	**43.9991**	NA	**0.02044**
Naphthalene	**10,000**	**10,000**	171.768	**4.088**	2.044
Acetone	**1,000**	**136.29**	41.1441	**10.22**	10.22
2-Butanone (MEK)	**1,000**	**146.24**	257.654	**5.11**	61.32
4-Methyl-2-pentanone (MIBK)	**1,000**	**407.48**	39.0001	**5.11**	8.176
Acrolein	NA	NA	**0.22353**	NA	**2.044**
Vinyl acetate	NA	NA	**434.097**	NA	**102.2**
Methyl-tert-butyl ether	NA	NA	**5.59375**	NA	**0.7154**
Carbon disulfide	NA	NA	**82.2042**	NA	**10.22**
Xylene (Total)	**1,000**	**1,000**	412.661	**204.4**	178

Notes:
1. The cleanup goals that will be used are indicated in boldface type. NA = No published value available.
2. VRP cleanup goals are from Voluntary Remediation Program Resource Guide (IDEM, July 1996).
3. RISC closure values are from Risk Integrated System of Closure Technical Resource Guidance Document (IDEM, August 2003).
4. The VRP Tier II groundwater criterion for chloroethane represents the VRP Tier II Residential criterion; there is no published VRP Tier II Non-Residential criterion.

Table 2
Soil and Groundwater Screening Results
Former Karwick Road Landfill
Michigan City, Indiana

	Subsurface Soil			Groundwater									
	VRP Tier II Cleanup Goals Residential Scenario (mg/kg)	VRP Tier II Cleanup Goals Non-Residential Scenario (mg/kg)	SAMPLE ID Soil (mg/kg) GB03-8'	VRP Tier II Cleanup Goals Residential Scenario (mg/L)	VRP Tier II Cleanup Goals Non-Residential Scenario (mg/L)	SAMPLE ID Groundwater (mg/L) GB01;071101	GB02;071101	GB03;071101	GB04;071101	GB05;071101	GB06;071201	GB07;071201	GB08;071201
Volatile Organic Compounds													
Methylene chloride	NL (0.02314) [3]	NL (1.76597) [3]	**39**	NL (0.005) [3]	NL (0.381547) [3]	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-dichloroethene	17.14	102.49	ND	0.070	1.022	ND	0.010	ND	ND	ND	ND	ND	ND
Chlorobenzene	NL (1.30316) [3]	NL (26.6365) [3]	ND	NL (0.1) [3]	NL (2.044) [3]	0.013	ND	ND	0.019	ND	0.0059	ND	ND
Xylenes (total)	1,000	1,000	190	10.0	204.4	ND	0.012	ND	ND	ND	ND	ND	0.012
1,3,5-trimethylbenzene	NL (0.6127) [3]	NL (68.8474) [3]	**66**	NL (0.016398) [3]	NL (5.11) [3]	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trimethylbenzene	NL (10.6693) [3]	NL (167.121) [3]	**730**	NL (0.07) [3]	NL (5.11) [3]	ND	0.0086	ND	ND	ND	0.0092	ND	ND
1,4-dichlorobenzene	0.897	34.67	ND	0.075	0.1192	ND	ND	ND	0.0055	ND	ND	ND	ND
Naphthalene	1,761.785	10,000	ND	1.216	4.088	0.0081	0.0085	ND	ND	ND	0.0058	ND	ND
4-methyl-2-pentanone (MIBK)	68.147	407.48	ND	1.520	5.110	ND	ND	0.120	ND	ND	ND	ND	ND
Semivolatile Organic Compounds													
Naphthalene	1,761.785	10,000	NT	1.216	4.088	ND	0.130	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	NL (15.706) [3]	NL (208.89) [3]	NT	NL (0.1536842) [3]	NL (2.044) [3]	ND	**0.330**	ND	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	16.427	1,406.25	NT	0.006	0.2043	ND	**0.130**	ND	ND	ND	ND	ND	ND
Priority Pollutant List Metals													
Antimony	584	584	NT	0.006	0.060	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	438	438	NT	0.050	0.050	ND	**0.509**	**0.224**	ND	ND	ND	ND	ND
Barium	10,000	10,000	NT	2.0	7.154	0.516	3.93	**2.86**	0.154	0.56	0.166	0.257	0.383
Cadmium	730	730	NT	0.005	0.0511	**0.0155**	**0.0794**	**0.0393**	ND	ND	ND	ND	**0.0113**
Chromium	7,300	7,300	NT	0.10	0.511	**0.114**	**1.05**	**0.356**	ND	ND	ND	ND	ND
Copper	NL (582.4) [3]	NL (1,694.07) [3]	NT	NL (1.3) [3]	NL (3.7814) [3]	0.257	**5.86**	0.872	ND	ND	0.0384	ND	0.0751
Lead	NL (81) [3]	NL (230) [3]	NT	NL (0.015) [3]	NL (0.042) [3]	**2.09**	**16.2**	**1.27**	ND	ND	**0.138**	ND	**0.811**
Nickel	10000	10,000	NT	0.10	2.044	0.0966	1.02	**0.436**	ND	ND	ND	ND	0.0833
Selenium	7,300	7,300	NT	0.050	0.511	ND	ND	ND	ND	ND	ND	ND	ND
Silver	7,300	7,300	NT	0.152	0.511	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	NL (2.848) [3]	NL (13.098) [3]	NT	NL (0.002) [3]	NL (0.009198) [3]	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	10,000	10,000	NT	9.12	30.68	1.54	17.9	4.87	ND	ND	0.569	ND	0.668
Mercury	87.6	87.6	NT	0.002	0.0061	ND	**0.0242**	**0.0044**	ND	ND	ND	ND	ND

Notes: (1) Only those constituents detected at least once are shown, with the exception of PPL metals which are all listed.
(2) Soil concentrations are in mg/kg; groundwater concentrations are in mg/L.
(3) NL = No published VRP Tier II cleanup goal. The value in parentheses is the default Risk Integrated System of Closure (RISC) Residential closure criteria.
(4) ND = Not detected.
(5) NT = Not tested for this constituent.
(6) Bold values exceed applicable published closure criteria for a Residential land use. Shaded and bold values exceed criteria for a Non-Residential land use

Table 3
Groundwater Analytical Results
Former Karwick Road Landfill
Michigan City, Indiana

Constituents[1]	Groundwater VRP Tier II Cleanup Goals Residential Scenario[2] (mg/L)	Groundwater VRP Tier II Cleanup Goals Non-Residential Scenario (mg/L)	SAMPLE ID Groundwater (mg/L)[3] MW-1		MW-2		MW-3		MW-4		MW-5		MW-6		MW-7		MW-8	
			MW-1;120301 12/3/2001	MW-1;111003 11/10/2003	MW-2;120301 12/3/2001	MW-2;111003 11/10/2003	MW-3;120301 12/3/2001	MW-3;111003 11/10/2003	MW-4;120301 12/3/2001	MW-4;111003 11/10/2003	MW-5;120301 12/3/2001	MW-5;111003 11/10/2003	MW-6;120301 12/3/2001	MW-6;111003 11/10/2003	MW-7;120301 12/3/2001	MW-7;111103 11/11/2003	MW-8;120301 12/3/2001	MW-8;111003 11/10/2003
Volatile Organic Compounds																		
Chloroethane	23.16075	NL (23.16075)	ND[4]	ND	0.0082	ND	0.011	ND	1.60	0.47	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	0.640	10.22	ND	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	0.005	0.0986	ND	ND	**0.011**[5]	ND	**0.0053**	**0.0054**	**0.019**	**0.015**	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	1.00	20.44	ND	ND	ND	ND	ND	ND	0.090	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	0.005	0.260	ND	**0.0062**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	NL (0.1)	NL (2.044)	ND	ND	0.066	0.035	0.020	ND	0.022	0.020	0.0067	ND	0.021	0.021	ND	ND	**0.150**	0.095
Xylene (total)	10.0	204.4	ND	ND	ND	ND	ND	ND	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	NL (0.07)	NL (5.11)	ND	ND	0.028	0.0060	0.0095	ND	0.042	0.013	ND	ND	ND	ND	ND	ND	0.035	0.018
1,3,5-Trimethylbenzene	NL (0.016398)	NL (5.11)	ND	ND	ND	0.0053	ND	ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	0.600	NL (0.09198)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0093	ND
1,4-Dichlorobenzene	0.075	0.119233	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.011	ND
Naphthalene	1.216	4.088	ND	ND	ND	ND	ND	ND	0.073	0.060	ND	ND	ND	ND	0.0055	ND	0.0078	0.013
Semivolatile Organic Compounds																		
bis(2-Ethylhexyl)phthalate	0.006	0.2043	ND	ND	**0.018**	ND	ND	ND	**0.044**	ND	ND	ND	**0.015**	**0.017**	**0.025**	ND	**0.011**	ND
1,3-Dichlorobenzene	0.600	NL (0.09198)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0092
Naphthalene	1.216	4.088	ND	ND	ND	ND	ND	ND	0.043	0.035	ND	ND	ND	ND	ND	ND	ND	0.0072
Priority Pollutant List Metals																		
Arsenic	0.050	0.050	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.013	ND	ND	ND	ND	ND	ND
Barium	2.0	7.154	ND	ND	0.242	ND	0.290	ND	0.428	ND	0.339	ND	0.241	ND	0.710	ND	0.596	ND
Cadmium	0.005	0.0511	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.011**	ND
Chromium	0.10	0.511	ND	ND	ND	ND	ND	ND	0.0716	ND	ND	ND	0.0637	ND	0.0889	ND	**0.155**	ND
Copper	NL (1.3)	NL (3.7814)	ND	ND	0.0431	ND	0.0213	ND	0.109	ND	ND	ND	0.0375	ND	0.167	ND	0.151	ND
Lead	NL (0.015)	NL (0.042)	0.0139	ND	**0.171**	ND	**0.0189**	ND	**0.222**	0.014	ND	ND	**0.0515**	ND	**0.866**	ND	**0.279**	ND
Nickel	0.10	2.044	ND	ND	ND	ND	ND	ND	0.0671	ND	ND	ND	ND	ND	0.060	ND	**0.155**	ND
Selenium	0.05	0.511	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0118	ND	ND
Zinc	9.12	30.66	0.0524	ND	0.833	ND	0.0829	ND	0.845	0.0749	0.0508	ND	0.211	ND	1.55	ND	1.04	ND
Mercury	0.002	0.0061	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.00218**	ND	ND	ND

Notes:
1. Only those constituents detected at least once are shown.
2. NL = No published VRP Tier II cleanup goal. The value in parentheses is the default Risk Integrated System of Closure (RISC) Residential closure criteria, except for chloroethane, where the value in parenthesis represents the VRP Tier II Residential criterion.
3. Groundwater concentrations are in milligrams per liter (mg/L).
4. ND = Not detected.
5. Bold values exceed applicable published closure criteria for a Residential land use. Shaded and bold values exceed criteria for a Non-Residential land use.

Table 4
Groundwater Duplicate Samples - Relative Percent Difference
Former Karwick Road Landfill
Michigan City, Indiana

Constituents	MW-3 vs DUP-1 (mg/L)			MW-5 vs DUP (mg/L)		
	MW-3 MW-3;120301 12/03/01	DUP-1	Relative Percent Difference[3]	MW-5 MW-5;111003 11/10/03	DUP;111003	Relative Percent Difference
Volatile Organic Compounds						
Benzene	0.0053	0.0053	0.0%	ND[4]	ND	NA[5]
Chlorobenzene	0.020	0.012	50.0%	ND	ND	NA
Chloroethane	0.011	0.0087	23.4%	ND	ND	NA
1,2,4-Trimethylbenzene	0.0095	ND	116.7%	ND	ND	NA
Semivolatile Organic Compounds						
bis(2-Ethylhexyl)phthalate	ND	0.012	82.4%	ND	ND	NA
Priority Pollutant List Metals						
Arsenic	ND	ND	NA	0.013	ND	88.9%
Barium	0.290	0.330	12.9%	ND	ND	NA
Copper	0.0213	0.0243	13.2%	ND	ND	NA
Lead	0.0189	0.0156	19.1%	ND	ND	NA
Zinc	0.0829	0.0716	14.6%	ND	ND	NA

Notes:
1. Only constituents detected in at least one sample are listed.
2. Concentrations in mg/L (millograms per liter).
3. The relative percent difference (RPD) is equal to the absolute difference between the concentrations of the two samples divided by the average concentration of the two samples, and then multiply the value by 100 to convert it into percentage. For non-detects, 1/2 the detection limit was used as a surrogate concentration value.
4. Constituent not detected (ND) above its detection limit.
5. Not applicable (NA).

Table 6
Sediment Sample Analytical Results
Former Karwick Road Landfill
Michigan City, Indiana

Constituent	VRP Residential Cleanup Goal (mg/kg)[2]	VRP Non-Residential Cleanup Goal (mg/kg)	Sample ID									
			SD-1;062303	SD-2;062303	SD-3;062303	SD-4;062303	SD-5;062303	SD-6;062303	BSD-1;062403	BSD-2;062403	BSD-3;062403	BSD-4;062403
Semivolatile Organic Compounds												
Fluoranthene	2,160	10,000	ND (0.330)[5]	ND (0.330)	ND (0.330)	ND (0 330)	ND (0.330)	5.40	ND (0.330)	ND (0.330)	ND (5.0)	ND (3.5)
Priority Pollutant List Metals												
Arsenic	81	612	4.97	2.49	2.00	ND (1.60)	ND (2.02)	ND (2.02)	4.71	3.85	2.05	2.04
Barium	10,000	10,000	25.5	61 5	13.5	11.5	9.06	20.8	25.4	49.0	38.3	43.5
Chromium	1,350	10,000	3.64	3.10	2.27	2 08	ND (2.02)	7 98	3.48	5 20	12.5	7.33
Copper	NL (580)[6]	NL (1,700)	2.82	3.13	ND (1 71)	ND (1 60)	ND (2.02)	7 21	2.18	4.93	13.3	6.66
Lead	400	1,000	5.18	2.49	2.19	1.79	ND (2 02)	15 6	4 26	3 69	45.7	15.2
Nickel	5,400	10,000	4.62	3.66	2.29	1.91	ND (2 02)	2.81	4.03	7 03	4.56	4.33
Zinc	10,000	10,000	29.7	13 1	12.2	11.5	ND (20.2)	53 7	29.4	26.9	97.8	72.7
PCBs												
Aroclor 1254	0.08	7.53	ND (0.016)	ND (0 016)	ND (0.016)	ND (0.016)	ND (0 016)	ND (0 016)	ND (0 016)	ND (0.016)	ND (0 016)	0.044

Notes:

1. Only constituents detected in at least one sample are listed.
2. Reference: *VRP Resource Guide* (July 1996).
3. All values are mg/kg (milligrams per kilogram)
4. Sediment samples analyzed by Pace Analytical Services, Inc. of Indianapolis, Indiana for SVOCs using SW-846 Method 8270, PPL metals using SW-846 Methods 6010 and 7471, and PCBs using SW-846 Method 8082.
5. Constituent not detected (ND) in the sediment sample, laboratory detection limit given in parentheses
6. Constituent not listed (NL) in VRP Tier II Non-Residential Cleanup Goals table. RISC Industrial Default Closure Criterion given in parentheses

Table 7
Sediment Duplicate Sample - Relative Percent Difference
Former Karwick Road Landfill
Michigan City, Indiana

Constituent[1]	SDDUP-1;062303 vs. SD-2;062303		
	SDDUP-1[2,3]	SD-2	Relative Percent Difference[4]
Semivolatile Organic Compounds	ND[5]	ND	NA[6]
Priority Pollutant List Metals			
Arsenic	1.99	2.49	22.3%
Barium	93.8	61.5	41.6%
Chromium	2.31	3.10	29.2%
Copper	4.12	3.13	27.3%
Lead	ND	2.49	87.0%
Nickel	3.50	3.66	4.5%
Zinc	ND	13.1	28.8%
PCBs	ND	ND	NA

Notes:

1. Only constituents detected in at least one sample are listed.
2. Results presented in mg/L (milligrams per liter).
3. Soil samples analyzed by Pace Analytical Services, Inc. of Indianapolis, Indiana for VOCs using SW-846 Method 8260 and SVOCs using SW-846 Method 8270.
4. The relative percent difference (RPD) is equal to the absolute difference between the concentrations of the two samples divided by the average concentration of the two samples, and then multiply the value by 100 to convert it into percentage. For non-detects, 1/2 the detection limit was used as a surrogate concentration value.
5. Constituent not detected (ND) in the soil sample.
6. Not applicable (NA).

Table 8
Sediment MS/MSD Sample - Relative Percent Difference & Percent Recovery
Former Karwick Road Landfill
Michigan City, Indiana

Constituent[1]	MS/MSD SD-4;062303					
	Concentration (mg/kg)[2]		Relative Percent Difference	Percent Recovery		Acceptable Range of Percent Recovery[5]
	MS[3]	MSD[4]		MS	MSD	
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	2.049	2.208	7.0%	62	66	44-114
1,4-Dichlorobenzene	1.930	1.956	1.0%	58	59	35-109
2,4-Dinitrotoluene	2.429	2.594	7.0%	73	78	40-121
2-Chlorophenol	2.450	2.374	3.0%	74	71	51-108
4-Chloro-3-methylphenol	2.502	2.662	6.0%	75	80	58-113
4-Nitrophenol	2.712	2.751	1.0%	81	82	51-120
Acenaphthene	2.424	2.670	10.0%	73	80	44-122
N-Nitrosodi-n-propylamine	3.848	3.499	10.0%	115	105	42-120
Pentachlorophenol	2.267	2.119	7.0%	68	64	30-119
Phenol	2.706	2.605	4.0%	81	78	47-111
Pyrene	2.475	2.511	1.0%	74	75	46-125
Metals						
Antimony	44.33	45.57	3%	92	93	75-125
Arsenic	52.80	54.31	3%	107	108	75-125
Barium	57.95	59.99	3%	97	99	75-125
Cadmium	4.202	4.305	2%	87	88	75-125
Chromium	50.29	51.35	2%	100	100	75-125
Copper	48.60	50.02	3%	99	100	75-125
Lead	46.29	47.06	2%	93	92	75-125
Mercury	0.8641	0.8646	0%	103	103	46-131
Nickel	47.55	48.34	2%	95	95	75-125
Selenium	46.63	47.94	3%	96	97	75-125
Silver	4.850	4.977	3%	101	102	75-125
Thallium	42.23	44.19	5%	88	90	75-125
Zinc	51.55	64.51	22%	83	108	75-125
PCBs						
Aroclor 1016	0.06450	0.06950	7%	77	83	50-150
Aroclor 1260	0.07917	0.08133	3%	95	98	50-150

Notes:
1. Only constituents that were analyzed are listed.
2. All values in mg/kg (milligrams per kilogram).
3. MS Matrix spike
4. MSD Matrix spike duplicate
5. Acceptable range of % recovery provided by Pace Analytical Services, Inc.

Table 5
Groundwater MS/MSD Samples - Relative Percent Diference & Percent Recovery
Former Karwick Road Landfill
Michigan City, Indiana

Constituent	MS/MSD (December 3, 2001 Sampling Event)					
	Concentration (mg/L)		Relative Percent Difference	Percent Recovery		Acceptable Range of Percent Recovery
	MS	MSD		MS	MSD	
Volatile Organic Compounds						
1,1-Dichloroethene	0.01435	0.01227	16%	72	61	41-152
Benzene	0.03809	0.03114	20%	93	59	57-145
Trichloroethane	0.01688	0.01474	14%	84	74	53-140
Toluene	0.03106	0.1111	113%	0[6]	104	59-139
Chlorobenzene	0.04274	0.04043	6%	105	94	63-129
Semivolatile Organic Compounds						
1,4-Dichlorobenzene	0.05658	0.05461	4%	57	55	18-93
Phenol	0.04282	0.04134	3%	43	41	10-64
2-Chlorophenol	0.07222	0.07183	1%	72	72	10-113
N-Nitroso-di-n-propylamine	0.09674	0.09604	1%	97	96	40-125
1,2,4-Trichlorobenzene	0.05662	0.05507	3%	57	55	23-99
4-Chloro-3-methylphenol	0.09607	0.09774	2%	96	98	10-137
Acenaphthene	0.07673	0.07555	2%	77	76	40-113
4-Nitrophenol	0.04651	0.04877	5%	46	49	10-69
2,4-Dinitrotoluene	0.08013	0.08141	2%	80	81	38-121
Pentachlorophenol	0.1076	0.09431	13%	108	94	10-133
Pyrene	0.07952	0.0803	1%	80	80	25-135
Priority Pollutant List Metals						
Antimony	0.7838	0.8232	5%	78	82	75-125
Arsenic	0.9716	1.036	6%	94	101	75-125
Barium	1.345	1.436	7%	92	101	75-125
Cadmium	0.0946	0.1012	7%	90	96	75-125
Chromium	0.9852	1.042	6%	91	97	75-125
Copper	1.049	1.118	6%	94	101	75-125
Lead	1.117	1.192	6%	90	97	75-125
Nickel	0.9803	1.038	6%	91	97	75-125
Selenium	0.9378	0.9958	6%	94	99	75-125
Silver	0.0968	0.1029	6%	96	102	75-125
Thallium	0.8982	0.9714	8%	90	97	75-125
Zinc	1.706	1.822	7%	86	98	75-125
Mercury	0.0052	0.0053	1%	95	97	80-120

Constituent	MS/MSD:111003 (November 10, 2003 Sampling Event)					
	Concentration (mg/L)		Relative Percent Difference	Percent Recovery		Acceptable Range of Percent Recovery
	MS	MSD		MS	MSD	
Volatile Organic Compounds						
1,1-Dichloroethene	0.05799	0.05391	7%	116	108	41-152
Benzene	0.05105	0.04960	3%	102	99	57-145
Trichloroethane	0.05727	0.05294	8%	102	93	53-140
Toluene	0.04978	0.05151	3%	100	103	59-139
Chlorobenzene	0.04852	0.05035	4%	97	101	63-129
Semivolatile Organic Compounds						
1,4-Dichlorobenzene	0.1654	0.1714	4%	76	79	18-93
Phenol	0.1216	0.1254	3%	56	58	10-64
2-Chlorophenol	0.1848	0.1853	0%	85	85	10-113
N-Nitroso-di-n-propylamine	0.1921	0.2038	6%	88	94	40-125
1,2,4-Trichlorobenzene	0.1652	0.1670	1%	76	77	23-99
4-Chloro-3-methylphenol	0.2079	0.2034	2%	96	94	10-137
Acenaphthene	0.2012	0.2023	1%	93	93	40-113
4-Nitrophenol	0.1571	0.1679	7%	72	77	10-69
2,4-Dinitrotoluene	0.2024	0.2085	3%	93	96	38-121
Pentachlorophenol	0.2602	0.2652	2%	120	122	10-133
Pyrene	0.2013	0.2120	5%	93	98	25-135
Priority Pollutant List Metals						
Antimony	1.041	1.026	1%	104	103	75-125
Arsenic	1.036	1.025	1%	104	102	75-125
Beryllium	0.0987	0.1000	1%	99	100	75-125
Cadmium	0.0966	0.0965	0%	97	96	75-125
Chromium	0.9899	0.9880	0%	99	99	75-125
Copper	1.008	0.9950	1%	100	99	75-125
Lead	0.9731	0.9730	0%	97	97	75-125
Nickel	0.9675	0.9648	0%	96	96	75-125
Selenium	0.9897	0.9854	0%	99	98	75-125
Silver	0.1042	0.1024	2%	104	102	75-125
Thallium	0.9655	0.9707	1%	96	97	75-125
Zinc	0.9900	0.9723	2%	97	95	75-125
Mercury	0.0050	0.0050	1%	100	100	80-120

Notes:
1. Percent recovery analysis performed by Pace Analytical Services, Indianapolis, IN.
2. Concentrations in mg/L (millograms per liter).
3. MS - Matrix spike.
4. MSD - Matrix spike duplicate.
5. Acceptable range of % recovery provided by Pace Analytical Services, Inc.
6. Numbers in bold are outside the acceptable range of % recovery.
7. Semivolatile MS/MSD data taken from sample MW-5;111003. Pace did not spike MS/MSD;111003 for semivolatiles.

Table 9
Surface Water Analytical Results
Former Karwick Road Landfill
Michigan City, Indiana

Constituent	VRP Residential Cleanup Goal (mg/l)	SW-1			SW-2		
		SW-1;062303 6/23/2003	SW-1;091603 9/16/2003	SW-1;122303 12/23/2003	SW-2;062303 6/23/2003	SW-2;091603 9/16/2003	SW-2;122303 12/23/2003
Volatile Organic Compounds							
Carbon disulfide	NL (1.3)[5]	0.0096	ND (0.005)[6]	ND (0.005)	0.0096	ND (0.005)	ND (0.005)
Acetone	3.04	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)
Toluene	1.00	ND (0.005)	ND (0.005)	0.0083	ND (0.005)	ND (0.005)	ND (0.005)
Semivolatile Organic Compounds	NA[7]	ND	ND	ND	ND	ND	ND

Constituent	VRP Residential Cleanup Goal (mg/l)	SW-3			SW-4		
		SW-3;062303 6/23/2003	SW-3;091603 9/16/2003	SW-3;122303 12/23/2003	SW-4;062303 6/23/2003	SW-4;091603 9/16/2003	SW-4;122303 12/23/2003
Volatile Organic Compounds							
Carbon disulfide	NL (1.3)[5]	0.010	ND (0.005)	ND (0.005)	0.013	ND (0.005)	ND (0.005)
Acetone	3.04	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	0.033	ND (0.025)
Toluene	1.00	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Semivolatile Organic Compounds	NA[7]	ND	ND	ND	ND	ND	ND

Constituent	VRP Residential Cleanup Goal (mg/l)	SW-5			SW-6		
		SW-5;062303 6/23/2003	SW-5;091603 9/16/2003	SW-5;122303 12/23/2003	SW-6;062303 6/24/2003	SW-6;091603 9/16/2003	SW-6;122303 12/23/2003
Volatile Organic Compounds							
Carbon disulfide	NL (1.3)[5]	0.011	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Acetone	3.04	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)
Toluene	1.00	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Semivolatile Organic Compounds	NA[7]	ND	ND	ND	ND	ND	ND

Constituent	VRP Residential Cleanup Goal (mg/L)	BSW-1	BSW-2	BSW-3	BSW-4
		BSW-1;062403 6/24/2003	BSW-2;062403 6/24/2003	BSW-3;062403 6/24/2003	BSW-4;062403 6/24/2003
Volatile Organic Compounds					
Carbon disulfide	NL (1.3)[5]	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Acetone	3.04	ND (0.025)	ND (0.025)	ND (0.025)	ND (0.025)
Toluene	1.00	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)
Semivolatile Organic Compounds	NA[7]	ND	ND	ND	ND

Notes
1. Only constituents detected in at least one sample are listed
2. References *VRP Resource Guide*(IDEM, July 1996), *RISC Technical Resource Guidance Document*(IDEM September 2001)
3. All values in mg/L (milligrams per liter).
4. Surface water samples analyzed by Pace Analytical, Inc. of Indianapolis, IN for VOCs using SW-846 Method 8260 and SVOCs using SW-846 Method 8270.
5. Constituent not listed (NL) in VRP Tier II Residential Cleanup Goals table. Value in parenthesis is default RISC Residential value
6. Constituent not detected (ND) in the soil sample, laboratory detection limit given in parentheses
7. Not applicable (NA)

Table 10
Surface Water Duplicate Samples - Relative Percent Difference
Former Karwick Road Landfill
Michigan City, Indiana

Constituent[1]	SWDUP-1;062303 vs. SW-2;062303			SWDUP-1;091603 vs. SW-2;091603		
	SWDUP-1[2,3]	SW-2	Relative Percent Difference[4]	SWDUP-1	SW-2	Relative Percent Difference[4]
Volatile Organic Compounds						
Carbon disulfide	**0.013**	**0.0096**	**30.1%**	ND	ND	NA
Methylene chloride	**0.0053**	ND[5]	**71.8%**	ND	ND	NA
Semivolatile Organic Compounds	ND	ND	NA[6]	ND	ND	NA

Constituent[1]	SWDUP-1;122303 vs. SW-2;122303		
	SWDUP-1	SW-2	Relative Percent Difference[4]
Volatile Organic Compounds			
Carbon disulfide	ND	ND	NA
Methylene chloride	ND	ND	NA
Semivolatile Organic Compounds	ND	ND	NA

Notes.
1 Only constituents detected in at least one sample are listed
2 Results presented in mg/L (milligrams per liter)
3. Surface water samples analyzed by Pace Analytical, Inc of Indianapolis, IN for VOCs using SW-846 Method 8260 and SVOCs using SW-846 Method 8270.
4 The relative percent difference (RPD) is equal to the absolute difference between the concentrations of the two samples divided by the average concentration of the two samples, and then multiply the value by 100 to convert it into percentage For non-detects, 1/2 the detection limit was used as a surrogate concentration value.
5 Constituent not detected (ND) in the surface water sample
6 Not applicable (NA)

Table 11
Surface Water MS/MSD Samples - Relative Percent Difference & Percent Recovery
Former Karwick Road Landfill
Michigan City, Indiana

Constituent	MS/MSD SW-4;062303 Concentration (mg/L) MS	MSD	Relative Percent Difference	Percent Recovery MS	MSD	Acceptable Range of Percent Recovery
Volatile Organic Compounds						
1,1-Dichloroethene	0.04416	0.04521	2%	88	90	41-152
Benzene	0.0407	0.04416	8%	81	88	57-145
Trichloroethene	0.03456	0.03989	14%	69	80	53-140
Toluene	0.03512	0.0403	14%	70	81	59-139
Chlorobenzene	0.0326	0.03965	19%	65	79	63-129
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	0.07685	0.07789	1%	68	68	23-99
1,4-Dichlorobenzene	0.07315	0.07383	1%	64	65	18-93
2,4-Dinitrotoluene	0.1031	0.1077	4%	91	95	38-121
2-Chlorophenol	0.08114	0.08686	7%	71	76	10-113
4-Chloro-3-methylphenol	0.08711	0.09395	8%	77	83	10-137
4-Nitrophenol	0.05634	0.06682	17%	50	59	10-69
Acenaphthene	0.0841	0.08863	5%	74	78	40-113
N-Nitrosodi-n-propylamine	0.08908	0.09601	7%	78	84	40-125
Pentachlorophenol	0.1017	0.1133	11%	90	100	10-133
Phenol	0.04519	0.04872	8%	40	43	10-64
Pyrene	0.09199	0.1008	9%	81	89	25-135

Constituent	MS/MSD SW-4;091603 Concentration (mg/L) MS	MSD	Relative Percent Difference	Percent Recovery MS	MSD	Acceptable Range of Percent Recovery
Volatile Organic Compounds						
1,1-Dichloroethene	0.05446	0.05000	9%	109	100	41-152
Benzene	0.04717	0.03632	26%	94	73	57-145
Trichloroethene	0.04352	0.02699	47%	87	54	53-140
Toluene	0.04831	0.02674	57%	97	**54** [6]	59-139
Chlorobenzene	0.04464	0.02120	71%	89	**42**	63-129
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	0.04938	0.05834	17%	49	58	23-99
1,4-Dichlorobenzene	0.04445	0.05165	15%	44	52	18-93
2,4-Dinitrotoluene	0.07128	0.08433	7%	71	84	38-121
2-Chlorophenol	0.06319	0.07097	12%	63	71	10-113
4-Chloro-3-methylphenol	0.0633	0.0758	18%	63	76	10-137
4-Nitrophenol	0.02469	0.02371	4%	25	24	10-69
Acenaphthene	0.06197	0.07352	17%	62	74	40-113
N-Nitrosodi-n-propylamine	0.07202	0.08618	18%	72	86	40-125
Pentachlorophenol	0.05545	0.06817	21%	55	68	10-133
Phenol	0.02756	0.02971	8%	28	30	10-64
Pyrene	0.06528	0.08275	24%	65	83	25-135

Constituent	MS/MSD SW-4;122203 Concentration (mg/L) MS	MSD	Relative Percent Difference	Percent Recovery MS	MSD	Acceptable Range of Percent Recovery
Volatile Organic Compounds						
1,1-Dichloroethene	0.05267	0.06020	13%	105	120	41-152
Benzene	0.04722	0.05380	13%	94	108	57-145
Trichloroethene	0.04562	0.05286	15%	91	106	53-140
Toluene	0.04349	0.04971	13%	85	97	59-139
Chlorobenzene	0.04537	0.05200	14%	91	104	63-129
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	0.05864	0.06587	12.0%	59	66	23-99
1,4-Dichlorobenzene	0.05534	0.06393	14.0%	55	64	18-93
2,4-Dinitrotoluene	0.08556	0.08441	1.0%	86	84	38-121
2-Chlorophenol	0.06444	0.07359	13.0%	64	74	10-113
4-Chloro-3-methylphenol	0.07332	0.08441	14.0%	73	84	10-137
4-Nitrophenol	0.03940	0.04015	2.0%	39	40	10-69
Acenaphthene	0.08104	0.08509	5.0%	81	85	40-113
N-Nitrosodi-n-propylamine	0.09596	0.09938	4.0%	96	99	40-125
Pentachlorophenol	0.07927	0.07863	1.0%	79	79	10-133
Phenol	0.02986	0.03326	11.0%	30	33	10-64
Pyrene	0.08738	0.08943	2.0%	87.0	89	25-135

Notes:
1. Only constituents that were analyzed are listed.
2. All values in mg/L (milligrams per liter).
3. MS - Matrix spike
4. MSD - Matrix spike duplicate
5. Acceptable range of % recovery provided by Pace Analytical Services, Inc.
6. Numbers in bold are outside the acceptable range of % recovery.

Table 12
Groundwater Elevation Data
Former Karwick Road Landfill
Michigan City, Indiana

Monitoring Well	Screened Interval (ft BGS[1])	Elevation Top of Riser (RDL)[2,3] (ft)	December 3, 2001		November 10, 2003	
			Depth to Groundwater (ft)	Groundwater Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)
MW - 1	12-17	101.95	12.65	89.30	12.60	89.35
MW - 2	12-17	93.86	15.21	78.65	15.02	78.84
MW - 3	12-17	90.66	12.75	77.91	13.03	77.63
MW - 4	12-17	95.04	15.53	79.51	15.84	79.20
MW - 5	8-13	90.70	11.44	79.26	11.71	78.99
MW - 6	8-13	93.53	13.86	79.67	14.18	79.35
MW - 7	12-17	99.05	11.12	87.93	12.64	86.41
MW - 8	14-19	100.02	15.95	84.07	16.62	83.40

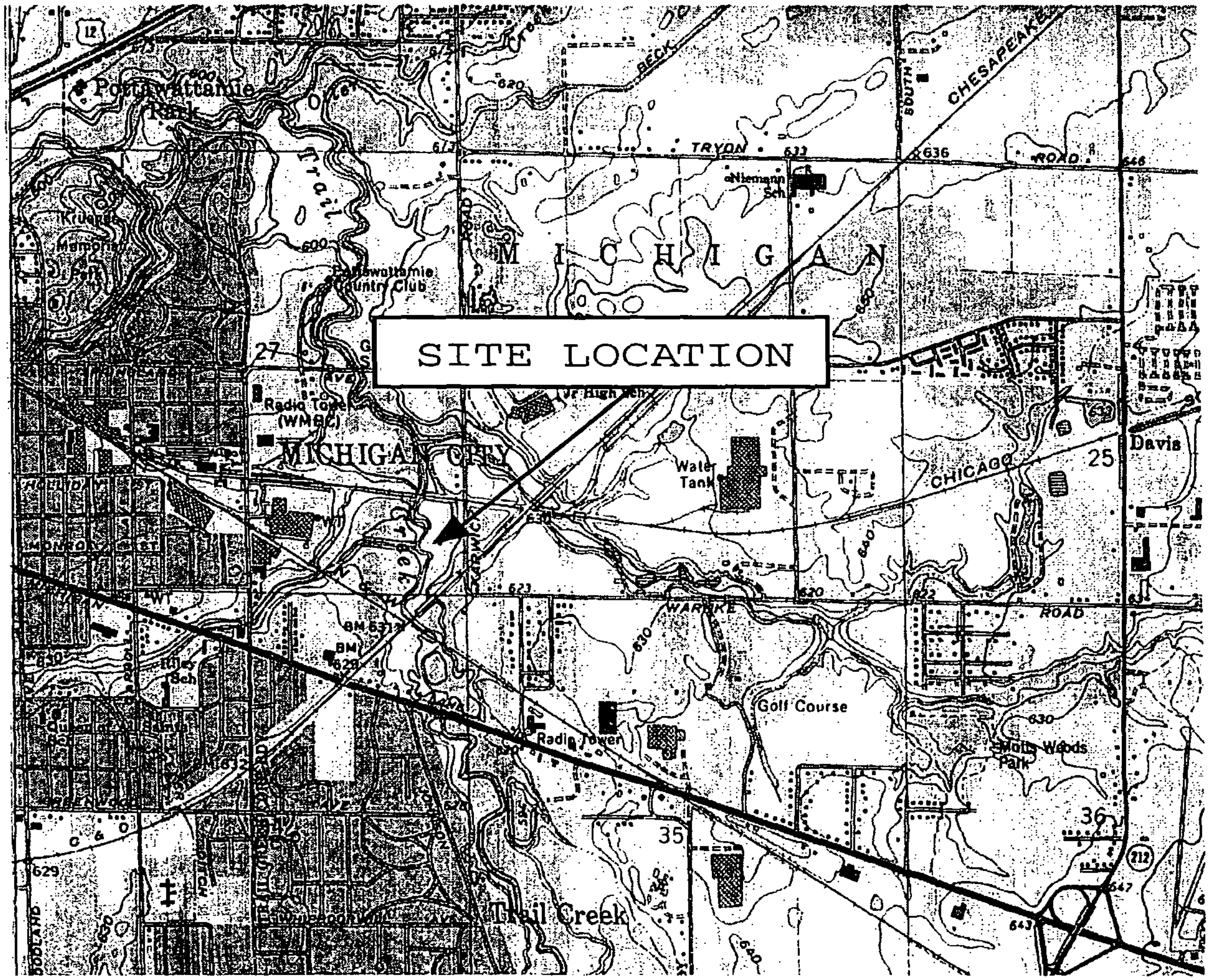
Notes:

1. BGS - Below ground surface.
2. All riser elevations surveyed by APT, Limited of Granger, IN.
   Elevations are referenced to an onsite benchmark established at an elevation of 100.00 ft. Local datum.
3. RDL - Reference Datum Level.

FIGURES

FIGURES

APT, LIMITED



USGS QUAD MICHIGAN CITY EAST, IN 7.5 MINUTE 1969 (REV. 1980)

SCALE
0 1000 2000 FEET

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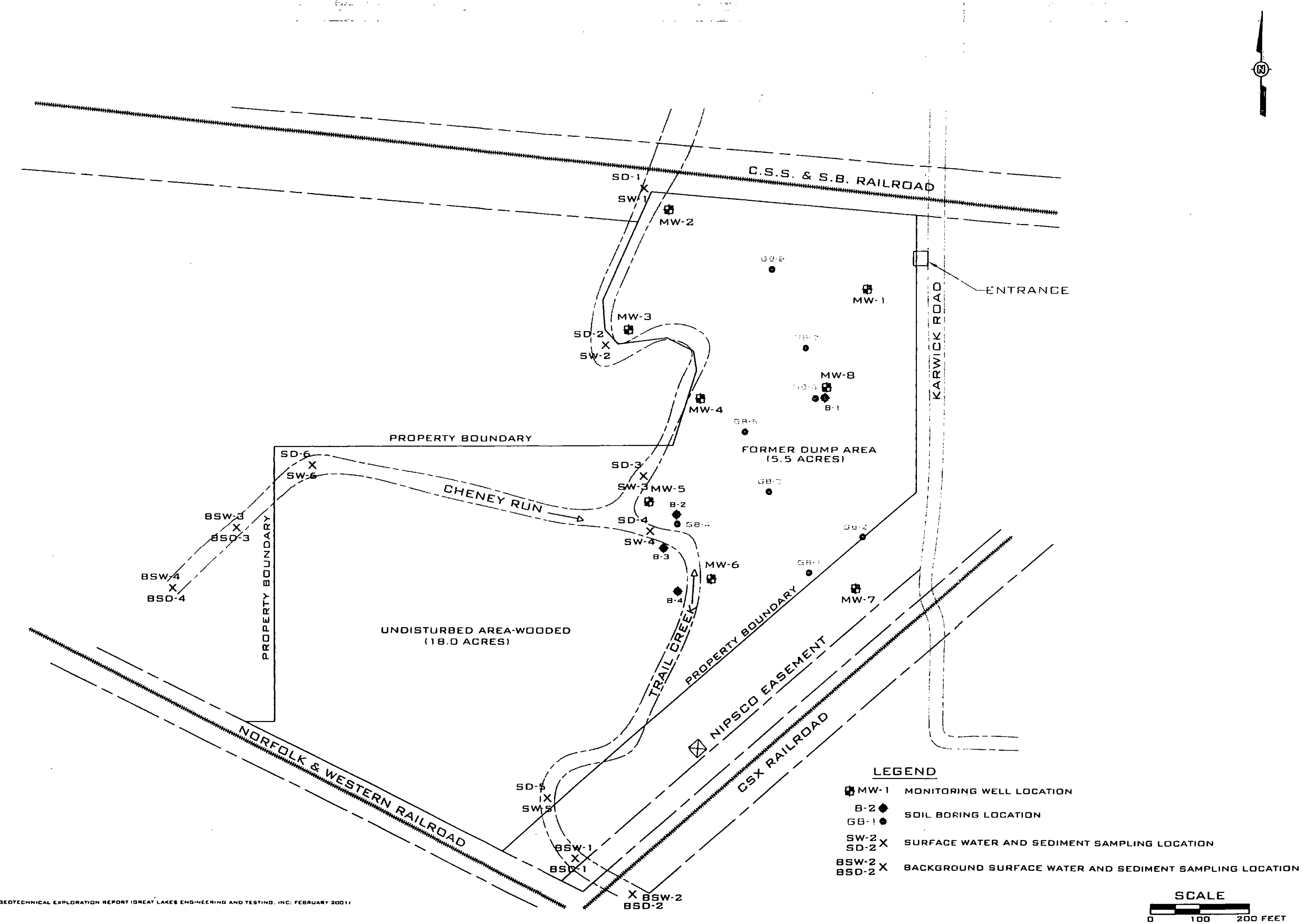
		DATE: 9-12-02 DWG BY: AB	PREPARED FOR M. C. PARKS & RECREATION MICHIGAN CITY, IN	SITE LOCATION MAP



REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC: FEBRUARY 2001)

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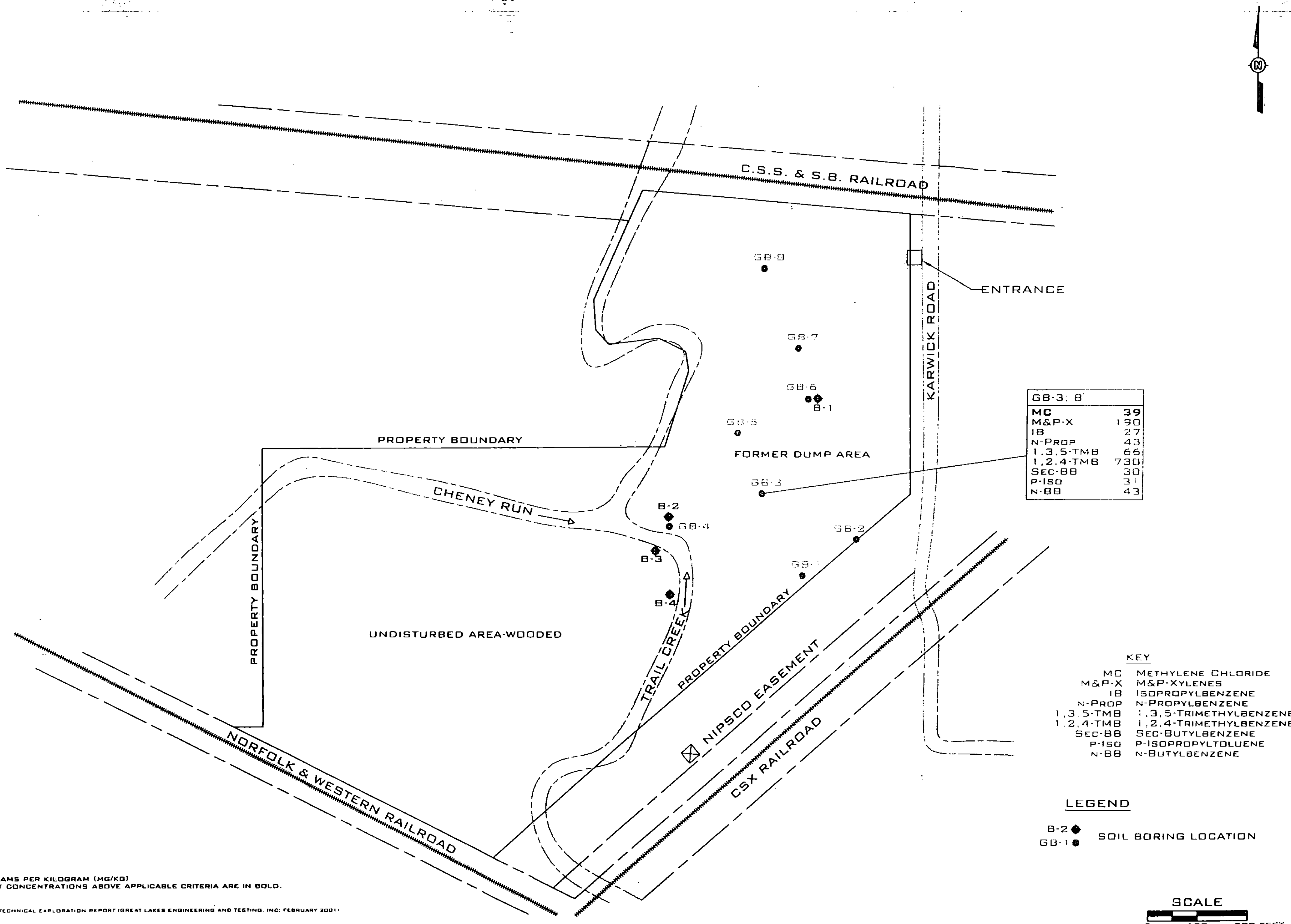


NOTE: 1. CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (MG/KG)
2. CONSTITUENTS DETECTED AT CONCENTRATIONS ABOVE APPLICABLE CRITERIA ARE IN BOLD.

REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC: FEBRUARY 2001)

APT

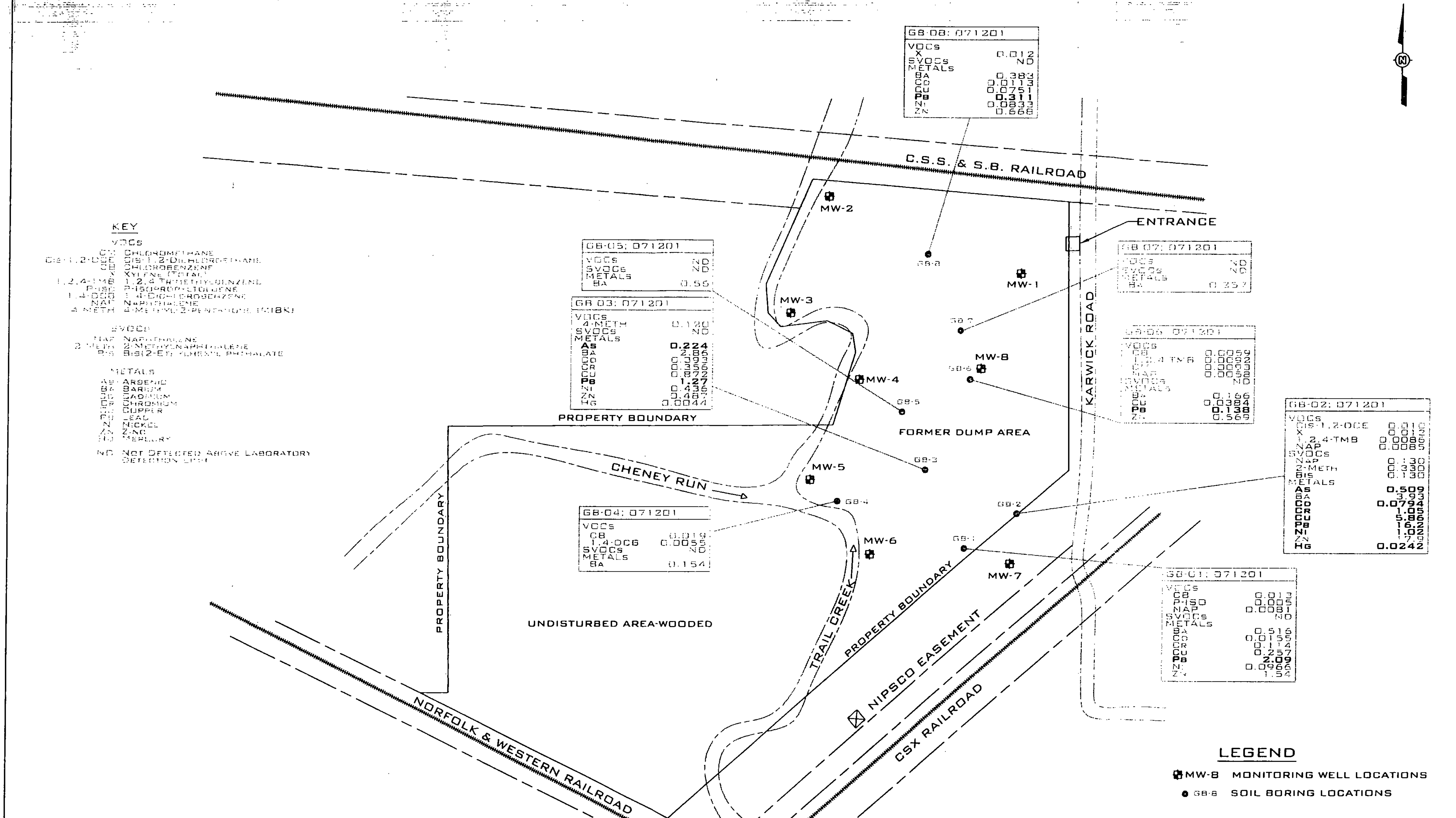
PROPERTY OF APT

TASK 8
DWG: 312.1.F3.SBAN
DATE: 3-6-03
DWG BY: AB

KARWICK ROAD SITE
MICHIGAN CITY, IN

PREPARED FOR
MICHIGAN CITY PARKS & RECREATION
MICHIGAN CITY, INDIANA

FIGURE 3
SOIL ANALYTICAL RESULTS
JULY, 2001



NOTES: 1. RESULTS PRESENTED IN MG/L.
2. INDIVIDUAL COMPOUNDS LISTED ONLY IF DETECTED IN SAMPLE.
3. CONSTITUENTS DETECTED AT CONCENTRATIONS ABOVE APPLICABLE CRITERIA ARE IN BOLD.

REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC; FEBRUARY 2001)

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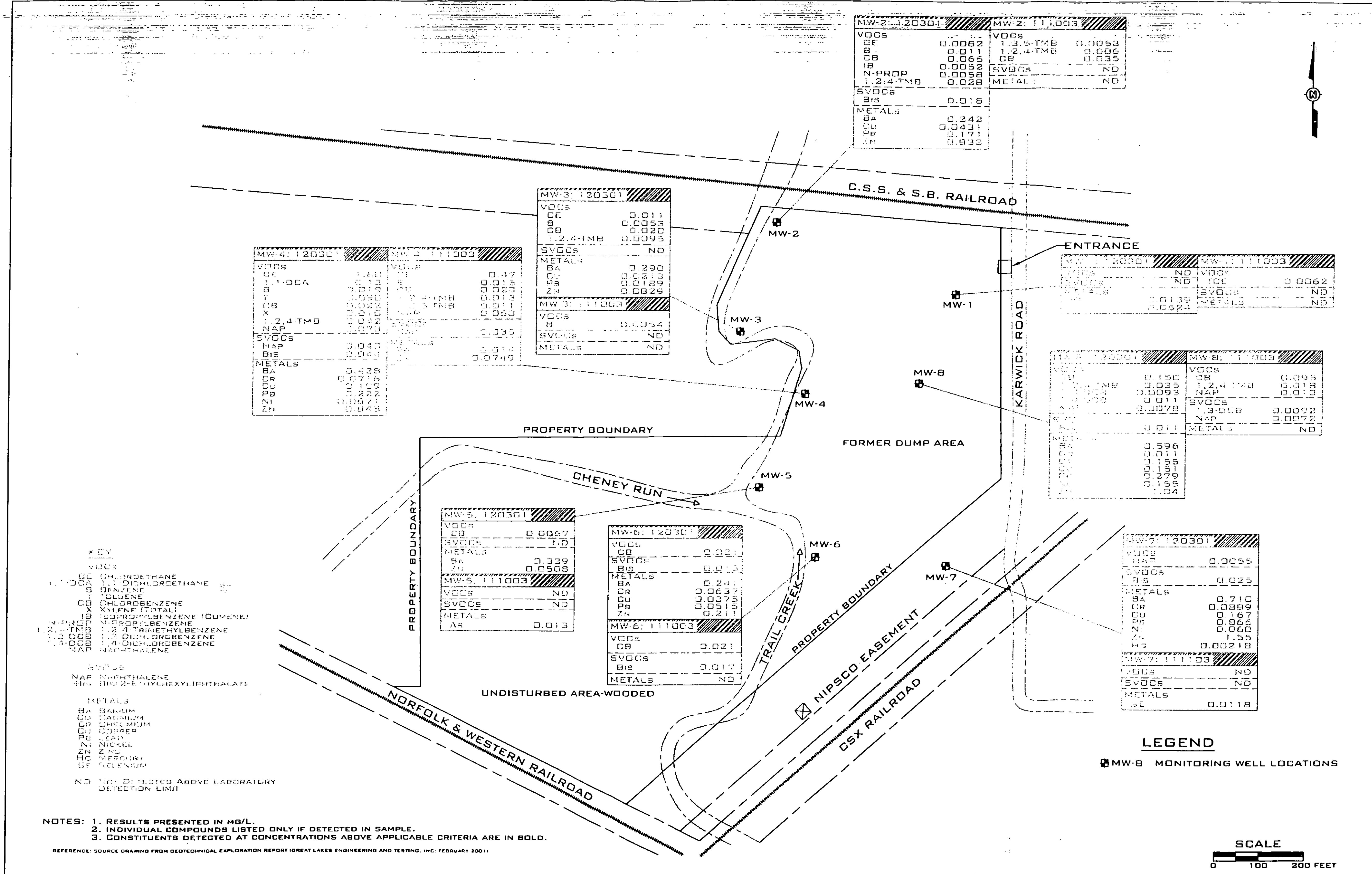

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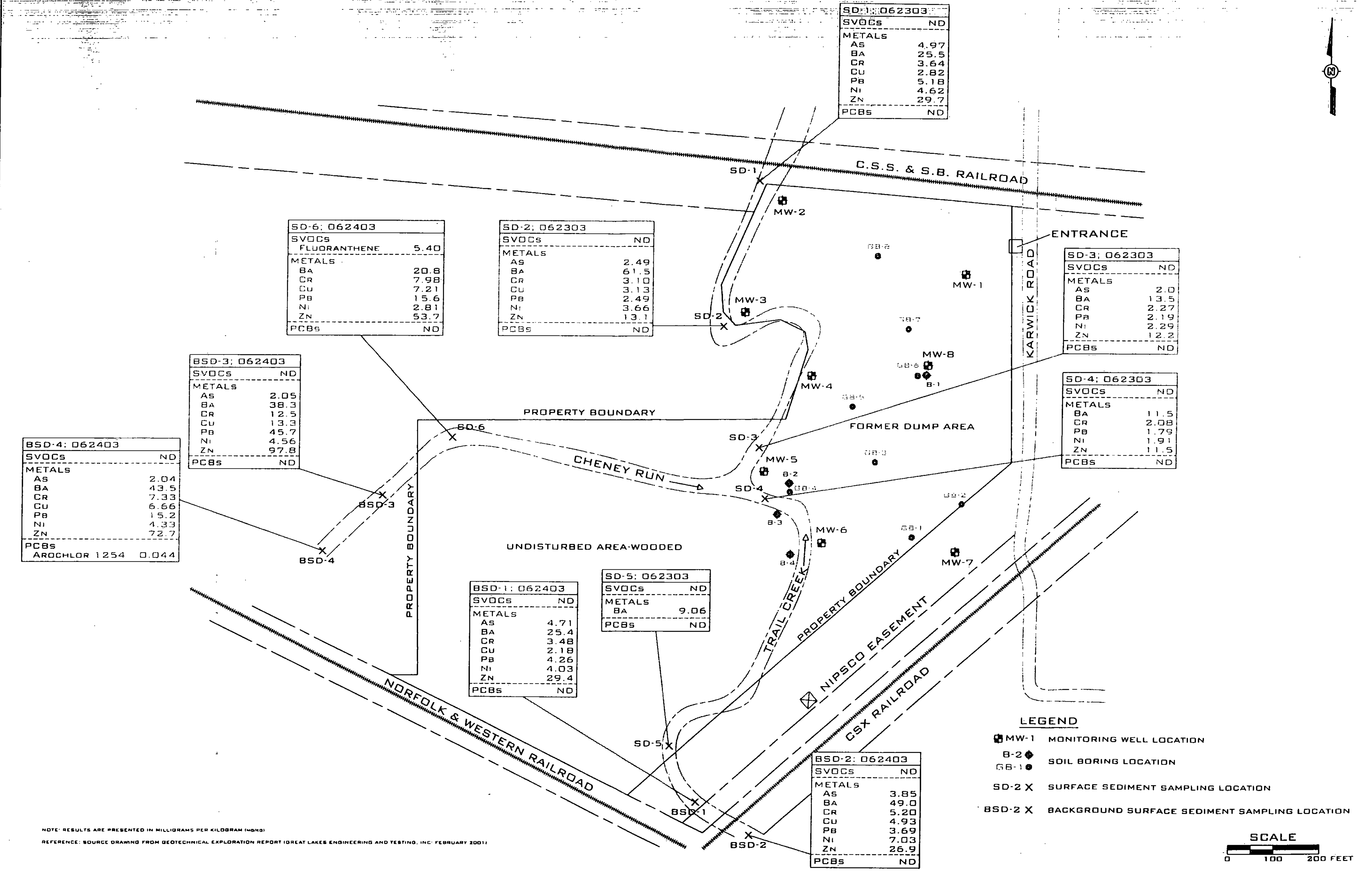
		DATE: 3-6-03 DWG BY: AB	PREPARED FOR MICHIGAN CITY PARKS & RECREATION MICHIGAN CITY, INDIANA	GROUNDWATER ANALYTICAL RESULTS



NOTE: RESULTS ARE PRESENTED IN MILLIGRAMS PER KILOGRAM (MG/KG)

REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC. FEBRUARY 2001)

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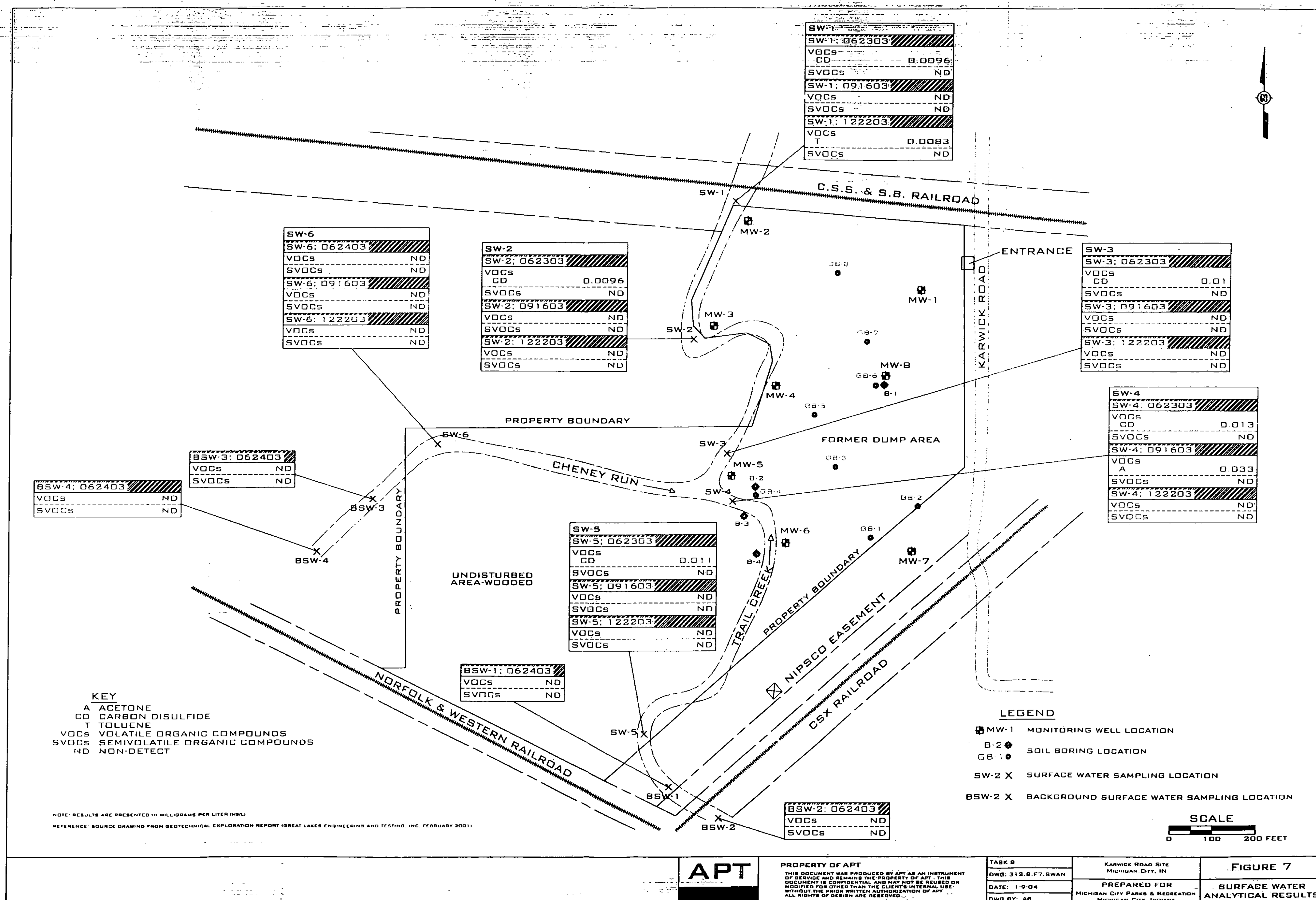
		DATE: 1-5-04 DWG BY: AB	PREPARED FOR MICHIGAN CITY PARKS & RECREATION MICHIGAN CITY, INDIANA	SEDIMENT SAMPLE ANALYTICAL RESULTS



SW-1
SW-1; 062303
VOCs CD 0.0096
SVOCs ND
SW-1; 091603
VOCs ND
SVOCs ND
SW-1; 122203
VOCs T 0.0083
SVOCs ND
C.S.S. & S.B. RAILROAD
SW-6
SW-6; 062403
VOCs ND
SVOCs ND
SW-6; 091603
VOCs ND
SVOCs ND
SW-6; 122203
VOCs ND
SVOCs ND
SW-2
SW-2; 062303
VOCs CD 0.0096
SVOCs ND
SW-2; 091603
VOCs ND
SVOCs ND
SW-2; 122203
VOCs ND
SVOCs ND
SW-3
SW-3; 062303
VOCs CD 0.01
SVOCs ND
SW-3; 091603
VOCs ND
SVOCs ND
SW-3; 122203
VOCs ND
SVOCs ND
SW-4
SW-4; 062303
VOCs CD 0.013
SVOCs ND
SW-4; 091603
VOCs A 0.033
SVOCs ND
SW-4; 122203
VOCs ND
SVOCs ND
SW-5
SW-5; 062303
VOCs CD 0.011
SVOCs ND
SW-5; 091603
VOCs ND
SVOCs ND
SW-5; 122203
VOCs ND
SVOCs ND
BSW-1; 062403
VOCs ND
SVOCs ND
BSW-2; 062403
VOCs ND
SVOCs ND
BSW-3; 062403
VOCs ND
SVOCs ND
BSW-4; 062403
VOCs ND
SVOCs ND
ENTRANCE
KARWICK ROAD
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
B-1
B-2
B-3
B-4
GB-1
GB-2
GB-3
GB-4
GB-5
GB-6
GB-7
GB-8
SW-1
SW-2
SW-3
SW-4
SW-5
SW-6
BSW-1
BSW-2
BSW-3
BSW-4
PROPERTY BOUNDARY
FORMER DUMP AREA
CHENEY RUN
TRAIL CREEK
UNDISTURBED AREA-WOODED
NIPSCO EASEMENT
CSX RAILROAD
NORFOLK & WESTERN RAILROAD
KEY
A ACETONE
CD CARBON DISULFIDE
T TOLUENE
VOCs VOLATILE ORGANIC COMPOUNDS
SVOCs SEMIVOLATILE ORGANIC COMPOUNDS
ND NON-DETECT
LEGEND
MW-1 MONITORING WELL LOCATION
B-2 GB-1 SOIL BORING LOCATION
SW-2 X SURFACE WATER SAMPLING LOCATION
BSW-2 X BACKGROUND SURFACE WATER SAMPLING LOCATION
SCALE
0 100 200 FEET
NOTE: RESULTS ARE PRESENTED IN MILLIGRAMS PER LITER (MG/L)
REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC. FEBRUARY 2001)
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DATE: 1-9-04
DWG BY: AB
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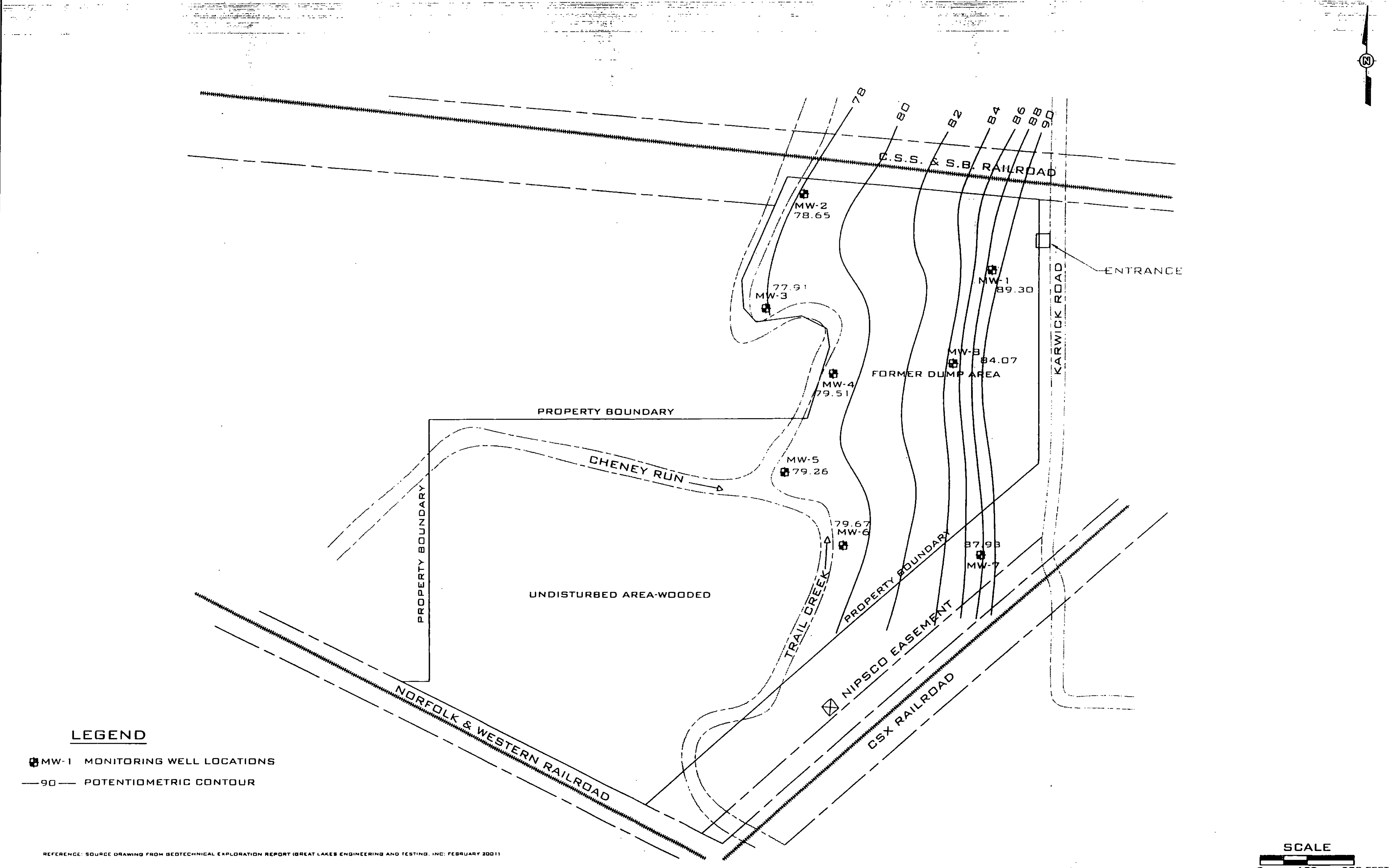
MICHIGAN CITY, IN
PREPARED FOR
MICHIGAN CITY PARKS & RECREATION
MICHIGAN CITY, INDIANA
FIGURE 7
SURFACE WATER ANALYTICAL RESULTS



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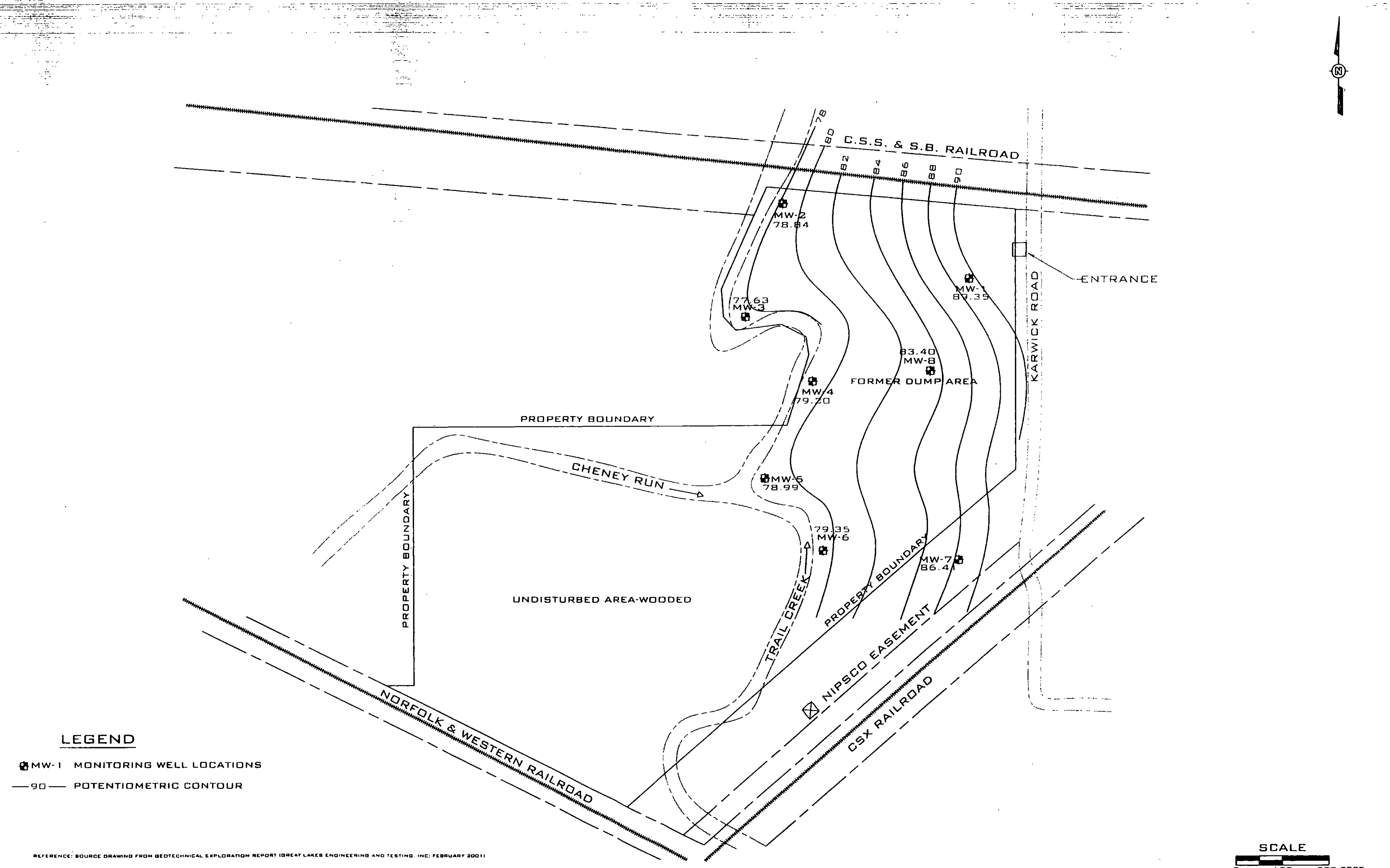

REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC: FEBRUARY 2001)

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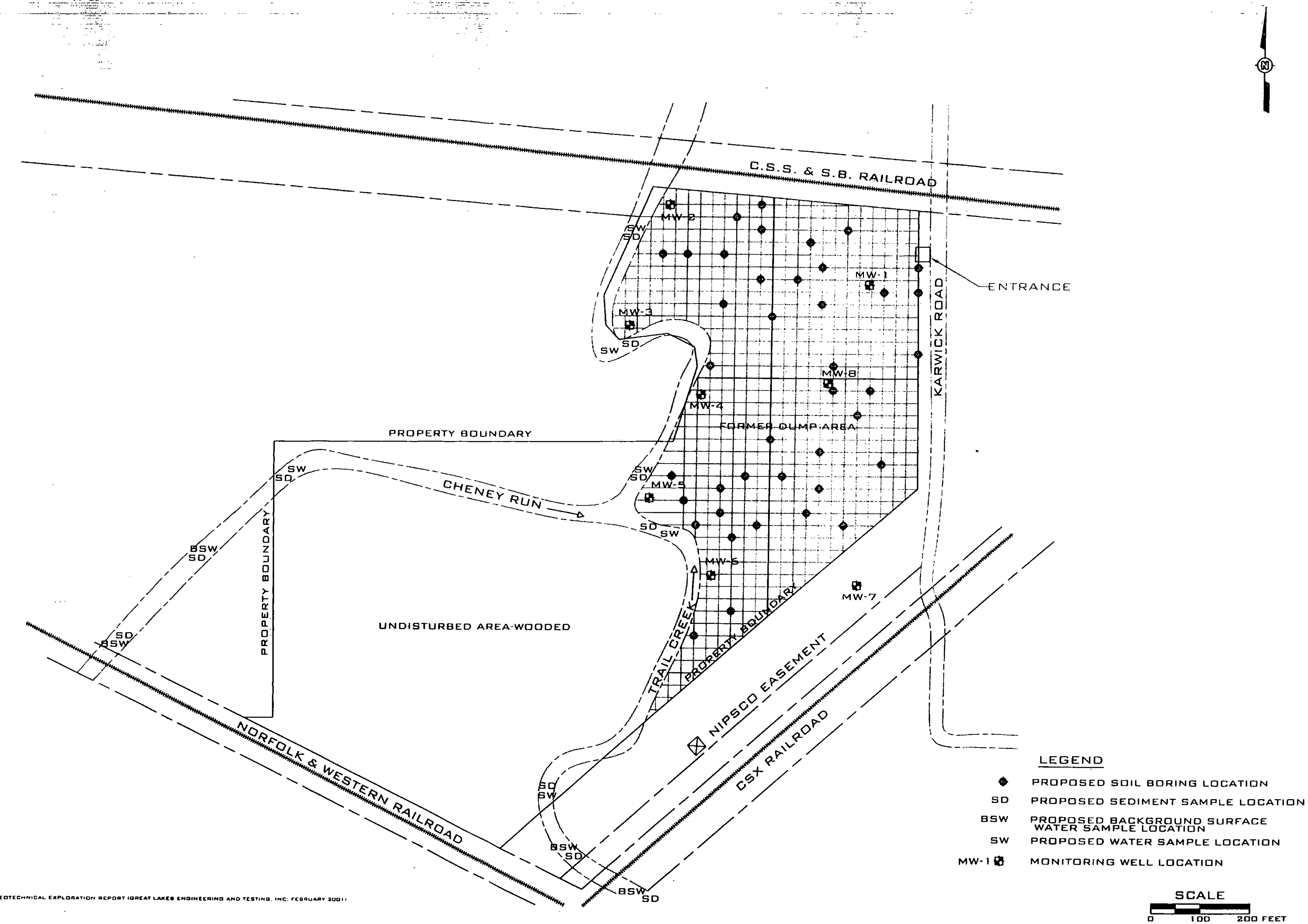

REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT (GREAT LAKES ENGINEERING AND TESTING, INC: FEBRUARY 2001)

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Appendix B
Bore Logs

APPENDIX B

BORE LOGS

APT, LIMITED

WEAVER BOOS & GORDON, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

Boring No.: B-1 | **File No.:** 0566-01-19 | **Page 1 of 1**

Project Name: Nature Park 2000
Location of Project: Michigan City, Indiana
Client Information: Haas & Associates

Water Level Data	Date/Time	Boring Information		Boring Location
19 Ft. While Drilling (below ground surface) (approximate)	Date Started: 1-12-01 Time: 1300	Drilling Co.: Top Flight	Drill Meth.: ATV D-50	STA. NA
		Driller: M.C.	Sampling Meth. SPT	O/S NA
___ Ft. at Completion (below ground surface)	Date Comp: 1-12-01 Time: 1545	Helper: R.J.	Type of Hammer: Automatic	ELE. 608.55'
		Logged By: C.H.		

Depth (ft.)	Lithology	Lithology Description	Samp. Interval	Sample No.	Blows/6in. (N Value)	Moisture	Moisture (%)	Penetrometer (tsf)	Recovery (in.)	Recovery %	Notes
0		FILL: loose brown sand and silty sand with roots mixed with brown and gray sandy silty clay		1	3-3-1 (4)				0		
5		REFUSE: paper, cardboard, wood, bottles (odor), glass mixed with brown and dark brown sand to silty sand		2	3-2-2 (4)				0		
				3	3-5-5 (10)	moist	17.6	NA	5		
10				4	5-7-7 (14)	moist	21.4		6		
				5	6-4-2 (6)				0		
15				6	4-1-4 (5)		100.5		0		
20		Very soft brown, gray, and dark gray ORGANIC SILT with trace to little clay, shells and gravel (OH)		7	1-0-1 (1)	wet	92.9	NA	16		
25				8	1-1-0 (1)	wet	28.8	NA	18		
30				9	1-0-1 (1)	moist	32.5	NA	18		
35		Very soft brown, gray, and dark gray ORGANIC CLAYEY SILT with trace sand, peat and shells (OH)		10	1-1-1 (2)	moist	35.2	NA	16		
40				11	1-1-2 (3)	moist	32.3	NA	18		
45				12	1-2-2 (4)	wet	29.1	NA	12		
50		Very loose to medium dense gray fine to medium SAND with little silt (SM)		13	3-1-2 (3)	wet	20.2	NA	8		
55				14	2-4-6 (10)	wet	20.5	NA	12		
60		Loose grayish brown fine to coarse SAND with trace silt (SP-SM)		15	4-5-4 (9)	wet	21.2	NA	18		
65		Medium dense to dense gray fine to medium SAND with trace to little silt (SP-SM to SM)		16	7-11-22 (33)	wet	20.8	NA	6		
70				17	6-13-16 (29)	wet	22.1	NA	18		
75				18	7-10-12 (22)	wet	22.1	NA	16		
		Boring Terminated at 75 ft.									

WEAVER BOOS & GORDON, INC.
ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS

Boring No.: B-2	File No.: 0566-01-19	Page 1 of 1
Project Name: Nature Park 2000		
Location of Project: Michigan City, Indiana		
Client Information: Haas & Associates		

Water Level Data	Date/Time	Boring Information		Boring Location
26 Ft. While Drilling (below ground surface) (approximate)	Date Started: 1-12-01 Time: 0830	Drilling Co.: Top Flight	Drill Meth.: ATV D-50	STA. NA
___ Ft. at Completion (below ground surface)	Date Comp: 1-12-01 Time: 1230	Driller: M.C.	Sampling Meth. SPT	O/S NA
		Helper: R.J.	Type of Hammer: Automatic	ELE. NA
		Logged By: C.H.		

Depth (ft.)	Lithology	Lithology Description	Samp. Interval	Sample No.	Blows/6in. (N Value)	Moisture	Moisture (%)	Penetrometer (tsf)	Recovery (in.)	Recovery %	Notes
0		FILL: dark brown silty sand with roots		1	4-1-2 (3)	moist	24.8	NA	1		
5		REFUSE: dark brown sand mixed with wood, cans, paper, and plastic		2	2-4-7 (11)			NA	0		
				3	1-2-6 (8)	moist	51.0	NA	1		
10				4	2-1-2 (3)	wet	22.3	NA	14		
		Very soft brown and gray ORGANIC SILT with little sand and trace clay and shells (OH)		5	1-1-1 (2)	wet	30.1	NA	12		
15		Very soft brown ORGANIC SILT with trace shells and clay (OH) (seams of dark brown peat in SS#-8) (trace wood in SS#-9)		6	1-1-0 (1)	moist	102.6	NA	18		
20				7	1-0-1 (1)	moist	47.0	NA	18		
25				8	2-1-0 (1)	moist	57.4	NA	18		
30				9	2-0-1 (1)	moist/ wet	33.3	NA	18		
35		Very soft brown and gray ORGANIC CLAYEY SILT with trace sand and peat seams (OH)		10	0-0-0 (0)	moist	92.3	NA	18		
40				11	1-1-1 (2)	moist	43.7	NA	18		
45				12	1-1-1 (2)	moist	34.5	NA	18		
50		Loose brown and gray fine to coarse SAND with some fine gravel and little silt (SM)		13	3-5-4 (9)	wet	13.6	NA	18		
55		Medium dense brown and gray SAND and fine to medium GRAVEL with trace silt (SP-SM)		14	6-8-10 (20)	wet	14.8	NA	10		
60		Medium dense to dense grayish brown fine to medium SAND with trace silt and fine to medium gravel (SP-SM)		15	6-13-24 (37)	wet	23.2	NA	10		
65				16	7-9-19 (28)	wet	19.6	NA	12		
70				17	7-9-16 (25)	wet	18.6	NA	18		
		Boring Terminated at 70 ft.									
75											

APT SOIL BORING LOG

Client: MI City Parks & Recreation	Page: 1 of 1
Project #: 312-01	Date: 7/11/01
Boring Name: GB-01	Reference Datum: Ground Level
Bore location: Approximately 210' E of creek and 150' NW of south property line	Driller/Method: Top Flight/GEO Probe
	Geologist/Engineer: J. Klanke

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	DP	NA	50		Fill	- brown, silty, moderately well sorted, 80-90% sand		Loose	10YR 4/2	Fill	Dry			
				ND										
									10YR 3/2		M			
						- becoming darker brown silty sand as above								
				ND	1									
						- 1" thick zone of brick rubble								
						- becoming siltier, 70% to 80% sand								
				ND										
						- wood fragments								
				ND	2									
					3									
					4									
2	DP	NA	25			- debris: mixed wood & paper								
				ND										
				ND										
					5									
					6									
					7									
					8	- becoming wet								
3	DP	NA	25								W			
				ND		- small angular rocks, glass & paper								
				ND										
					9									
					10	Total Depth = 11.5 feet below ground surface								

COHESIVE SOILS		GRANULAR SOILS		SAMPLE	SAMPLE TYPE
N	Consistency	"N"	Relative Density	MOISTURE	
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				DP = Direct Push

APT SOIL BORING LOG

Client: MI City Parks & Recreation	Page: 1 of 1
Project #: 312-01	Date: 7/11/01
Boring Name: GB-02	Reference Datum: Ground Level
Bore location: Approx. 70' W of Karwick Rd & 110' N of south property line	Driller/Method: Top Flight/GEO Probe
	Geologist/Engineer: J. Klanke

Sample No	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	DP	NA	50			Fill - - light brown, fine grained sand; moderately well sorted: 80%-90% sand		Loose	10YR 5/4	Fill	M			
				ND										
				ND	1									
						- abrupt change in color to dark brown; root fragments & angular rock fragments			10YR 4/3					
				ND					10YR 2/1					
				ND	2	- paper debris								
					3									
					4									
2	DP	NA	0			- NO RECOVERY 4'-8' wet at bottom of sampler								
					5									
					6									
					7									
											W			
					8	Total Depth = 8 feet below ground surface								
					9									
					10									

COHESIVE SOILS		GRANULAR SOILS		SAMPLE	SAMPLE TYPE
N	Consistency	"N"	Relative Density	MOISTURE	
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				DP = Direct Push

APT SOIL BORING LOG

Client: MI City Parks & Recreation
Project #: 312-01
Boring Name: GB-03
Bore location: Approximately 220' SE of boring B-2 and 320'W of Karwick Rd.

Page: 1 of 1
Date: 7/11/01
Reference Datum: Ground Level
Driller/Method: Top Flight/GEO Probe
Geologist/Engineer: J. Klanke

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	DP	NA	50		Fill	- brown, fine grained sand, 80%-90% sand		Loose	10YR 4/3	Fill	Dry			
				ND										
				ND	1									
						- brown fine grained sand, moderately well sorted, 80%-90% sand; glass fragments			10YR 5/3		M			
				ND										
				ND	2									
					3									
					4									
2	DP	NA	50			- as above								
				ND				Soft	10YR 2/1					
					5									
				39		- becoming dark brown; wood & paper debris; glass fragments								
				48										
				57	6	- very dark brown to green-brown; becoming wet; strong petroleum odor								
				10000 +										
					7									
					8									
3	DP	NA					x							
											W			
					9									
						Refusal Total Depth = 9.5 feet below ground surface								
					10									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				DP= Direct Push

APT SOIL BORING LOG

Client: MI City Parks & Recreation
Project #: 312-01
Boring Name: GB-05
Bore location: Approx. 100' east of creek & 200' northeast of B-2/GB-04

Date: 7/12/01
Reference Datum: Ground Level
Driller/Method: Top Flight/GEO Probe
Geologist/Engineer: J. Klanke

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	DP	NA	75			Fill - brown silty sand; poorly sorted; approximately 70%-80% sand; fine grained		Loose	10YR 5/3	Fill	Dry			
				ND										
				ND	1									
				ND		- becoming orange-brown color; moist; fine grained, moderately well sorted			10YR 4/4		M			
				ND	2									
				ND										
				ND	3									
						- sand becoming brown glass debris, wood fragments & paper			10YR 4/2					
					4									
2	DP	NA	25	4										
				68		- mixed brown fill sand, debris: fabric, paper, & glass								
				10	5									
					6									
					7									
					8									
3	DP	NA	0	NA		- NO RECOVERY - except in drive head which contained debris (paper & wood), very base of sampler wet								
					9									
					10									

COHESIVE SOILS

N	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm (Medium)
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

GRANULAR SOILS

"N"	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

SAMPLE MOISTURE

Dry = Dry
D = Damp
M = Moist
W = Wet

SAMPLE TYPE

ST = Shelby Tube
SS = Split Spoon
AC = Auger Cuttings
RC = Rock Core
LBS = Long Bore Sampler
DP= Direct Push

APT SOIL BORING LOG

Project #: 312-01 | Page: 2 of 2
Boring Name: GB-05 | Date: 7/12/01

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
3	(Continued)													
						- NO RECOVERY								
					11									
					12									
4	DP	NA	0	NA		- NO RECOVERY								
					13									
					14									
					15									
					16									
						Total Depth = 16 feet below ground surface								
					17									
					18									
					19									
					20									

COHESIVE SOILS		GRANULAR SOILS		SAMPLE MOISTURE	SAMPLE TYPE
N	Consistency	"N"	Relative Density		
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				DP = Direct Push

APT SOIL BORING LOG

Client: MI City Parks and Recreation
Project #: 312-01
Boring Name: MW-1
Bore location: Approximately 95 feet west of Karwick Road and 160 feet south of fence line near railroad track.

Date: 11-26-01
Reference Datum: GL
Driller/Method: H.S.A
Geologist/Engineer: K. Lechtanski
Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		50			FILL - Brown sand, fine to medium grained. Poorly sorted.		Loose	10 YR 3/2	SM	Dry			
		3		ND										
		3		ND	1	- Light brown, medium grained, poorly sorted			2.5 Y 4/5					
		2		ND										
		4		ND	2									
2	SS		25			- Silty sand			10 YR 3/6					
		3		ND		- Black stain								
		2		ND	3	- Plastic debris jamming cutter head								
		2		ND										
		2		ND	4									
3	SS		50						10 YR 4/3		M			
		2		ND										
		4		ND	5	- Plastic debris								
		4		ND					2.5 Y 4/3					
		6		ND	6	- Paper debris, black stain								
4	SS		0	NA		NO RECOVERY								
		21												
		49			7									
		50 (3")												
					8									
5	SS		0	NA		NO RECOVERY								
		12												
		14			9									
		5												
		1			10									

COHESIVE SOILS

N	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm (Medium)
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

GRANULAR SOILS

"N"	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

SAMPLE MOISTURE

Dry = Dry
D = Damp
M = Moist
W = Wet

SAMPLE TYPE

ST = Shelby Tube
SS = Split Spoon
AC = Auger Cuttings
RC = Rock Core
LBS = Long Bore Sampler

APT SOIL BORING LOG

Project #: 312-01
Boring Name: MW-1

Date: 11-26-01

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)		Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS		25			FILL	- Brown silty sand, poorly sorted, fine to medium grained		Loose	2.5 Y 5/3	SM	M			
		11		ND											
		9		ND	11		- Plastic debris, wood fragments								
		4		ND											
		4		ND	12										
7	SS		75												
		3		ND											
		1		ND	13										
		2		ND											
						SILT	- Dark brown, organic, little or no sand (<10%). Root fragments.		Loose	2.5 Y 2/1	ML	M			
		4		ND	14										
8	SS		100	NA		SAND	- Light brown to tan fine grained, well sorted		Loose	2.5 Y 5/2	SW	W			
		2													
		2			15		- Organic zone 1 inch thick.								
		7													
		9			16										
9	SS			NA											
		4				SILT	- Grayish brown, slightly sandy (10-20%), clayey		Stiff	2.5 Y 4/1	ML	M			
		4			17										
						CLAY	- gray, silty.		Stiff	2.5 Y 4/1	CL	M			
		5													
						SILT	- Becoming wet lower most 2 inches		Stiff	2.5 Y 4/1	ML	M			
		6			18		- Gray, slightly sandy.					W			
							TOTAL DEPTH = 18 feet								
					19										
					20										

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Client: MI City Parks and Recreation
Project #: 312-01
Boring Name: MW-2
Bore location: 50 feet southwest of last fence post by C.S.S.& S.B. Railroad
25 feet east of river

Date: 11-26-01
Reference Datum: GL
Driller/Method: H.S.A.
Geologist/Engineer: K. Lechtanski
Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		50			FILL - Light brown tan sand, well sorted, minor electrical debris.		Very Loose	10 YR 5/4	SW	Dry			
		1		ND										
		1		ND	1									
		1		ND										
		1		ND	2									
2	SS		25						10 YR 4/4					
		2		ND		- Paper & plastic debris jamming cutter head.								
		2		ND	3									
		4		ND										
		1		ND	4									
3	SS		0	NA		NO RECOVERY								
		2												
		2			5									
		4												
		1			6									
4	SS		10			FILL - Tan, brown sand, moderately sorted, with minor/trace amounts of silt. Wood debris.		Very Loose	10 YR 4/4	SM	Dry			
		3		ND										
		1		ND	7									
		3		ND										
		5		ND	8									
5	SS		0	NA		NO RECOVERY								
		3												
		4			9									
		2												
		2			10									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Project #: 312-01 | Page: 2 of 2
Boring Name: MW-2 | Date: 11-26-01

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS		0			NO RECOVERY (split tube is dry)								
		3		ND										
		3		ND	11									
		3		ND										
		3		ND	12									
7	SS		50			FILL - Brown sand, metal & glass debris.		Loose	10 YR 4/4	SM	Dry			
											M			
		4		ND										
		1		ND	13									
		2		ND										
						SAND - Gray silty sand, minor natural wood debris		Loose	10 YR 2/1	SM	M			
		2		ND	14									
8	SS		25	NA							W			
		2												
		1			15									
		2												
		2			16									
9	SS		0	NA		NO RECOVERY								
					17									
					18									
						TOTAL DEPTH = 18 feet								
					19									
					20									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Client: MI City Parks and Recreation
Project #: 312-01
Boring Name: MW-3
Bore location: Approximately 160 feet south of MW-2

Date: 11-26-01
Reference Datum: GL
Driller/Method: H.S.A.
Geologist/Engineer: K. Lechtanski
Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		50			FILL - Light brown medium grained sand, 80% sand, 6 inch organic horizon at the surface.		Loose	10 YR 2/2	SM	Dry			
		2		ND					10 YR 3/3					
		4		ND	1									
		6		ND										
		6		ND	2									
2	SS		0	NA		NO RECOVERY								
		10												
		5			3									
		5												
		2			4									
3	SS		10			FILL - Brown sandy fill with wood paper and plastic debris, 70% sand.		Loose	10 YR 3/3	SM	Dry			
		5		ND										
		6		ND	5									
		50 (5")		ND										
					6									
4	SS		0	NA		NO RECOVERY (Due to lost cap of split tube in hole.)								
		4												
		4			7									
		4												
		7			8									
5	SS		25			FILL - Brown sand with organic debris, 70-80% sand.		Loose	10 YR 3/3	SM	M			
		12		ND										
		14		ND	9									
		14		ND		- Dark brown/black silty sand, 60% sand.			10 YR 2/1		W			
		12			10									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Project #: 312-01 | Page. 2 of 2
Boring Name: MW-3 | Date: 11-26-01

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description		Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS	5, 7, 9, 4	25	NA	11, 12	FILL	- Brown silty sand, 50-60% sand, abundant silt. Paper debris.		Loose	10 YR 2/1	SM	W			
7	SS	2, 0, 1, 0	0	NA	13, 14		NO RECOVERY								
8	SS	1, 0, 1, 0	75	NA	15, 16	SILT	- Gray sandy silt, moderately well sorted, with minor clay and interbeds of organic material.		Very Loose	5 Y 4/2	MS	W			
9	SS	0, 0, 0, 0	100	NA	17, 18	CLAY	- Gray sandy silty clay, trace amounts of organic material		Very Loose	5 Y 4/2	CS	W			
					19, 20		TOTAL DEPTH = 18 feet								

COHESIVE SOILS		GRANULAR SOILS		SAMPLE MOISTURE	SAMPLE TYPE
N	Consistency	"N"	Relative Density		
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Client: MI City Parks and Recreation
Project #: 312-01
Boring Name: MW-4
Bore location: Approximately 280 feet south of MW-3 following the creek and 20 feet east of the creek.

Date: 11-26-01
Reference Datum: GL
Driller/Method: H.S.A
Geologist/Engineer: K. Lechtanski
Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		75	ND		FILL - Redish brown, iron stained, sandy silt, medium grained.		Firm	7.5 YR 4/3	MS	Dry			
		2												
		3			1									
		2												
		2			2									
2	SS		25	ND				Loose	7.5 YR 4/2					
		3												
		5			3									
		5												
		3			4	- Paper and plastic debris								
3	SS		10	ND		- Brown silty sand, medium grained, moderately well sorted.			7.5 YR 3/2	SM				
		7												
		2			5									
		2												
		2			6	- Plastic, paper, and metal debris								
4	SS		50	ND							M			
		5												
		2			7	- Newsprint, paper, and glass.								
		3												
		8			8									
5	SS		25	ND		- Newsprint, wood, plastic, and metal debris								
		7												
		2			9									
		3												
		4			10									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Project #: 312-01
Boring Name: MW-4

Page: 2 of 2
Date: 11-26-01

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS		0	NA		NO RECOVERY								
		5												
		3			11									
		3												
		4			12									
7	SS		0	NA		NO RECOVERY								
		6												
		3			13									
		4												
		6			14									
8	SS		50	NA		FILL - Gray silty sand		Loose	10 YR 3/1	SM	W			
		5												
		5			15									
		6												
		5			16									
9	SS		100	NA										
		3				CLAY - Sandy clay, poorly sorted, occasional clean sandy interbeds.		Soft	2.5Y 3/1	CS	W			
		2			17									
		1												
		1			18									
						TOTAL DEPTH = 18 feet								
					19									
					20									

COHESIVE SOILS N	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm (Medium)
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

GRANULAR SOILS "N"	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

SAMPLE MOISTURE
- Dry = Dry
- D = Damp
- M = Moist
- W = Wet

SAMPLE TYPE
- ST = Shelby Tube
- SS = Split Spoon
- AC = Auger Cuttings
- RC = Rock Core
- LBS = Long Bore Sampler

APT SOIL BORING LOG

Client: MI City Parks and Recreation	Page: 1 of 2
Project #: 312-01	Date: 11-27-01
Boring Name: MW-5	Reference Datum: GL
Bore location: Approximately 220 ft south of MW-4 following the creek.	Driller/Method: H.S.A
	Geologist/Engineer: K. Lechtanski
	Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		50			FILL - Brown sandy silt, fine grained, roots, plastic, and wood debris.		Loose	7.5 YR 2.5/2	MS	Dry			
		1		ND										
		3		ND	1									
		2		ND										
		1		ND	2									
2	SS		35											
		1		ND										
		3		ND	3	- Brown sandy silt, fine to medium grained, glass, wood, and plastic debris.			10 YR 3/4					
		2		ND										
		1		ND	4									
3	SS		10						10 YR 2/1		M			
		3		ND										
		1		ND	5	- plastic debris								
		1		ND										
		2		ND	6									
4	SS		50											
		6		ND										
		4		ND	7	- paper glass and plastic debris								
		6		0.7		- Charcoal gray sand, fine grained.	X		GLEY 1 2 5 M	S				
		5		ND	8									
5	SS		70			- Brown sandy silt, fine grained, metal and plastic debris.			10 YR 2/2	MS				
		8		ND										
		7		ND	9	- Silty sand, fine to medium grained.			10 YR 4/1	SM				
		6		ND										
		6		ND	10									

COHESIVE SOILS		GRANULAR SOILS		SAMPLE MOISTURE	SAMPLE TYPE
N	Consistency	"N"	Relative Density		
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Project #: 312-01	Page: 2 of 2
Boring Name: MW-5	Date: 11-27-01

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS	5 2 2 1	10	NA	11 12	SAND - Silty sand, medium grained, moderately well sorted. Animal burrows filled with sandy silt.		Loose	10 YR 4/1	SM	W			
7	SS	2 1 0 1	0	NA	13 14	NO RECOVERY								
					15 16 17 18 19 20	TOTAL DEPTH = 14 feet								

COHESIVE SOILS		GRANULAR SOILS		SAMPLE MOISTURE	SAMPLE TYPE
N	Consistency	"N"	Relative Density		
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Client: MI City Parks and Recreation	Page: 1 of 2
Project #: 312-01	Date: 11-27-01
Boring Name: MW-6	Reference Datum: GL
Bore location: 25 feet east of creek and 210 feet south of MW-5 following the creek.	Driller/Method: H.S.A
	Geologist/Engineer: K. Lechtanski
	Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)		Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		25			FILL	- Brown silty sand, fine to medium grained, moderately well sorted.		Loose	7.5 YR 3/4	SM	Dry			
		1		ND											
		0		ND	1		- Roots, and plastic debris.								
		2		ND											
		3		ND	2										
2	SS		10				Plastic, organic, and paper debris.								
		1		ND											
		2		ND	3										
		3		ND											
		8		ND	4		- Plastic debris plugged split spoon.								
3	SS		80				- Glass debris			7.5 YR 5/6		M			
		2		ND											
		2		ND	5										
							- Gray silty sand			10 YR 4/1					
		3		ND											
		6		ND	6										
4	SS		100				- Brown sand, fine to medium grained, moderately well sorted.			7.5 YR 5/6					
		5		ND											
						CLAY	- Gray/brown clay, 10-15% sand.		Firm	2.5 Y 4/1	C	M			
		6		ND	7										
		7		0.7											
						SAND	- Fine grained, well sorted.		Loose	2.5 Y 5/1	SW	M			
		7		ND	8										
5	SS		60												
		6		ND											
		5		ND	9										
		4		ND								W			
		3			10										

COHESIVE SOILS		GRANULAR SOILS		SAMPLE MOISTURE	SAMPLE TYPE
N	Consistency	"N"	Relative Density		
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Project #: 312-01 | Page: 2 of 2
Boring Name: MW-6 | Date: 11-27-01

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS		80	NA		SAND - Gray fine grained sand, moderately well sorted, gray clay nodules		Loose	2.5 Y 4/1	S	W			
		4												
		3			11									
		2												
		2			12									
7	SS		40	NA		- Silty sand, medium grained, poorly sorted, clay nondules.			2.5 Y 5/1	SM				
		2												
		1			13									
		1												
		2			14									
						TOTAL DEPTH = 14 feet								
					15									
					16									
					17									
					18									
					19									
					20									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Client: MI City Parks and Recreation
Project #: 312-01
Boring Name: MW-7
Bore location: 135 feet west of Karwick Road and 115 noorth from bottom of ditch along the souther railroad track (Norfolk and Western).

Date: 11-27-01
Reference Datum: GL
Driller/Method: H.S.A
Geologist/Engineer: K. Lechtanski
Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		60			FILL - Brown sand, fine to medium grained, concrete and plant debris.		Loose	10 YR 3/6	S	Dry			
		1		ND										
		4		ND	1									
		4		ND										
		4		ND	2									
2	SS		0	NA		NO RECOVERY (Might be wet. Scrap of metal blocking split spoon.)								
		3												
		3			3									
		2												
		3			4									
3	SS		20	NA		FILL - Brown sand, fine to medium grained.		Loose	10 YR 3/3	S	W			
		5												
		3			5									
		2												
		2			6									
4	SS		0	NA		NO RECOVERY								
		4												
		4			7									
		1												
		3			8									
5	SS		0	NA		NO RECOVERY (Scrap of metal blocking split spoon.)								
		4												
		5			9									
		9												
		20			10									

COHESIVE SOILS

N	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm (Medium)
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

GRANULAR SOILS

"N"	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

SAMPLE MOISTURE
Dry = Dry
D = Damp
M = Moist
W = Wet

SAMPLE TYPE
ST = Shelby Tube
SS = Split Spoon
AC = Auger Cuttings
RC = Rock Core
LBS = Long Bore Sampler

APT SOIL BORING LOG

Project #: 312-01
Boring Name: MW-7

Date: 11-27-01

Sample No.	Sample Type	Blows Per 6-Inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS		10	NA		FILL - Dark brown silty sand, fine to medium grained, poorly sorted, glass and metal debris		Loose	10 YR 3/3	SM	W			
		8												
		12			11									
		3												
		3			12									
7	SS		0	NA		NO RECOVERY								
		6												
		5			13									
		4												
		4			14									
8	SS		10	NA		FILL - Dark brown silty sand, fine to medium grained, poorly sorted. Ceramic, paper, and glass debris.		Loose	10 YR 2/2	SM	W			
		4												
		3			15									
		2												
		6			16									
9	SS		0	NA		NO RECOVERY								
		2												
		3			17									
		3												
		2			18									
10	SS		0	NA		NO RECOVERY								
		8												
		4			19									
		3												
		3			20									

COHESIVE SOILS

N	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm (Medium)
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

GRANULAR SOILS

"N"	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

SAMPLE MOISTURE

- Dry = Dry
- D = Damp
- M = Moist
- W = Wet

SAMPLE TYPE

- ST = Shelby Tube
- SS = Split Spoon
- AC = Auger Cuttings
- RC = Rock Core
- LBS = Long Bore Sampler

APT SOIL BORING LOG

Project #: 312-01
Boring Name: MW-7

Date: 11-27-01

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
13	SS		25	NA		SILT · Grayish brown clayey silt, snail shells		Soft	2.5 Y 3/1	CM	W			
		4												
		4			21									
		1												
		2			22									
						TOTAL DEPTH = 22 feet								
					23									
					24									
					25									
					26									
					27									
					28									
					29									
					30									

COHESIVE SOILS		GRANULAR SOILS		SAMPLE MOISTURE	SAMPLE TYPE
N	Consistency	"N"	Relative Density		
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Client: MI City Parks and Recreation	Page: 1 of 2
Project #: 312-01	Date: 11-27-01
Boring Name: MW-8	Reference Datum: GL
Bore location:	Driller/Method: H.S.A
	Geologist/Engineer: K. Lechtanski
	Driller: Top Flight

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description	Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
1	SS		50			FILL - Brown clayey silt, some pebbles, poorly sorted, concrete debris		Firm	10 YR 4/2	MC	Dry			
		7		ND										
		6		ND	1									
		7		ND										
		5		ND	2									
2	SS		25			- Brown sand, fine to medium grained, well sorted		Loose		SW				
		3		ND										
		9		ND	3									
		5		ND										
		5		ND	4									
3	SS		10			- Brown sand, fine to medium grained, well sorted, plastic and paper debris.			10 YR 3/1		M			
		3		ND										
		2		ND	5									
		2		ND										
		3		ND	6									
4	SS		10			- 100% newsprint and some glass and metal								
		4		ND										
		5		ND	7									
		5		ND										
		4		ND	8									
5	SS		10			- Brown sand, fine to medium grained, moderately well sorted, paper and glass debris.								
		4		ND										
		6		ND	9									
		2		ND										
		4		ND	10									

COHESIVE SOILS N	Consistency	GRANULAR SOILS "N"	Relative Density	SAMPLE MOISTURE	SAMPLE TYPE
0 - 1	Very Soft	0 - 4	Very Loose	Dry = Dry	ST = Shelby Tube
2 - 4	Soft	5 - 10	Loose	D = Damp	SS = Split Spoon
5 - 8	Firm (Medium)	11 - 30	Medium Dense	M = Moist	AC = Auger Cuttings
9 - 15	Stiff	31 - 50	Dense	W = Wet	RC = Rock Core
16 - 30	Very Stiff	> 50	Very Dense		LBS = Long Bore Sampler
> 30	Hard				

APT SOIL BORING LOG

Project #: 312-01 | Page: 2 of 2
Boring Name: MW-8 | Date: 11-27-01

Sample No.	Sample Type	Blows Per 6-inches	Recovery (%)	PID/OVM (ppm)	Depth (Feet)	Sediment Description		Sample Collection/Analyses	Consistence	Munsell Color	USCS Classification	Moisture	Static GW	Well Construction	Soil Log
6	SS		25			FILL	- Brown sand, fine to medium grained, moderately well sorted, newsprint, glass and metal debris.		Loose	10 YR 3/1	S	M			
		4		ND											
		4		ND	11										
		4		ND											
		4		ND	12										
7	SS		20				- newprint and glass debris.			10 YR 4/1					
		5		ND											
		4		ND	13										
		2		ND											
		3		ND	14										
8	SS		100												
		4		ND		SILT	- Clayey silt, paper, glass and metal debris.		Firm	7 5 YR 3/2	MC	M			
		4		ND	15										
		5		NA											
						SAND	- Silty sand, fine to medium grained, moderately well sorted.		Loose	7 5 YR 3/2	SM	W			
		6			16										
9	SS		50	NA			- Brown sand, fine to medium grained, poorly sorted, clay nodules				S				
		3													
		2			17					10 YR 4/1					
		1													
		2			18										
10	SS		50	NA			- same as above, but more peat.								
		3													
		3			19										
		1													
		2			20		TOTAL DEPTH = 20 feet								

COHESIVE SOILS

N	Consistency
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm (Medium)
9 - 15	Stiff
16 - 30	Very Stiff
> 30	Hard

GRANULAR SOILS

"N"	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

SAMPLE MOISTURE

- Dry = Dry
- D = Damp
- M = Moist
- W = Wet

SAMPLE TYPE

- ST = Shelby Tube
- SS = Split Spoon
- AC = Auger Cuttings
- RC = Rock Core
- LBS = Long Bore Sampler

Appendix C
Ecological
Database Search

APPENDIX C

ECOLOGICAL DATABASE SEARCH RESULTS

APT, LIMITED

RECEIVED
MAY 22 2003

May 19, 2003

Ms. Kelly R. Lechtanski
APT, Limited
6910 North Main Street
Unit #17 - Building #2
Granger, IN 46530

Dear Ms. Lechtanski:

I am responding to your request for information on the endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented from a project area, Karwick Road site, Michigan City, Indiana. The Indiana Natural Heritage Data Center has been checked and enclosed you will find information on the ETR species and significant areas documented from the project area.

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. You should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
(812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. For more information, please contact:

John Goss, Director
Department of Natural Resources
attn: Christie Kiefer
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-4080

Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-8059 if you have any questions or need additional information.

Sincerely,

Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

enclosure: data sheet
invoice

****** Effective March 1, 2003, the Indiana Natural Heritage Data Center, Indiana Department of Natural Resources will be assessing a fee for information requests based on the time needed to complete the request. This charge will be $30 per one half hour, one half hour minimum. Most requests take one half hour or less to complete. An invoice for the amount due will be included with the completed request response.*

ENDANGERED, THREATENED AND RARE SPECIES,
HIGH QUALITY NATURAL COMMUNITIES, AND SIGNIFICANT NATURAL AREAS DOCUMENTED
FROM A PROJECT AREA, KARWICK ROAD SITE, MICHIGAN CITY, INDIANA

'E	SPECIES NAME	COMMON NAME	STATE	FED	LOCATION	DATE	COMMENT
HIGAN CITY EAST							
ular	EQUISETUM VARIEGATUM	VARIEGATED HORSETAIL	SE	**	T38NR04W 34 NEQ NEQ	1980	
ular	SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES	SR	**	T38NR04W 34 NEQ NEQ	1980	

STATE: SX=extirpated, SE=endangered, ST=threatened, SR=rare, SSC=special concern, WL=watch list, SG=significant, ** no status but rarity warrants concern
FEDERAL: LE=endangered, LT=threatened, LELT=different listings for specific ranges of species, PE=proposed endangered, PT=proposed threatened, E/SA=appearance similar to LE species, **=not listed

United States Department of the Interior

FISH AND WILDLIFE SERVICE

BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, IN 47403-2121
(812) 334-4261 FAX (812) 334-4273

August 13, 2003

RECEIVED
AUG 18 2003

Ms. Kelly Lechtanski
APT, Limited
6910 North Main Street
Unit #17 - Building #2
Granger, Indiana 46530

Dear Ms. Lechtanski:

This is in response to your letter dated May 12, 2003 requesting information regarding the potential occurrence of critical habitat and/or Federally endangered and threatened species for a site in Michigan City, LaPorte County, Indiana. The site is located near the intersection of Karwick Road and Warnke Road in Section 27 of Township 38 North and Range 4 West of the Michigan City East Quadrangle.

In May, 2002, a letter was sent from our office to Mr. John Klanke of APT, Limited in Granger, Indiana regarding this same area. Since that time the information has changed slightly. Please consider the information in this letter as the most current information.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

Any Covenant Not To Sue (CNTS) for natural resource damages granted by the State of Indiana under its Voluntary Remediation Program (VRP) would not represent nor perhaps encompass the position of the federal natural resource trustees under Section 122(j) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended. This letter does not represent formal review of this project by the Department of the Interior (DOI) and therefore, in no way should be construed to represent a position as to whether or not a CNTS for natural resource damages to federal trust resources would be appropriate.

THREATENED AND ENDANGERED SPECIES

The area described in your letter is within the range of the Federally endangered Indiana bat (*Myotis sodalis*) and the Federally threatened bald eagle (*Haliaeetus leucocephalus*).

The Indiana bat uses woodlands during the summer when maternity colonies utilize trees with loose bark for roosting. These bats forage primarily over wooded stream corridors, although they have been collected in grazed woodlots, mature deciduous forests, and pastures with trees. There are records of the Indiana bat within the Kankakee River system in LaPorte County. While there have been no surveys in the Trail Creek watershed, suitable bat habitat probably exists along portions of the creek in the vicinity of the project. If any tree clearing or habitat alteration is planned for this remediation project near Trail Creek please recoordinate with our office immediately.

Bald eagles nest in close proximity to lakes, rivers, or reservoirs. They construct their nests near habitat ecotones, such as lakeshores, rivers, and timber management areas (clearcuts or selective cuts). Tolerance of human activity during the nesting season has been variable, but, ideally, human disturbance of eagles should be avoided. The bald eagle's food base from the watershed includes carrion, waterfowl, and especially fish. There are wintering records for the bald eagle in LaPorte County.

In the event that Federally-listed species are found within the project area or determined to be adversely affected by project plans, further coordination may be required under the Endangered Species Act of 1973, as amended.

OTHER SPECIES OF CONCERN

In addition to the above-mentioned species, there are two State-listed plant species found in the area: The variegated horsetail (*Equisetum variegatum*) and the shining ladies' tresses (*Spiranthes lucida*). These are listed as endangered and rare, respectively. Peregrine falcons are also State-listed and have been recorded in Michigan City. Finally, Trail Creek supports a significant salmonid resource and the harbor and beach areas towards the mouth of the creek are used by numerous migrating birds.

Contamination from these sites may migrate to adjacent wetlands, Trail Creek, Lake Michigan, or other areas of ecological significance. Pathways of migration may include leachate/ground water, surface water, and sediment. Under conditions that allow certain contaminants to accumulate in waterways, aquatic organisms can bioaccumulate these elements; consequently, elevated or toxic concentrations may be reached. We recommend that sampling and monitoring efforts address the potential for off-site migration of any possible contaminants.

The attached National Wetland Inventory (NWI) maps indicate that there are palustrine, forested; palustrine, emergent; palustrine, scrub-shrub; palustrine, open-water; and riverine wetlands adjacent to and near the areas of interest. Water and other habitat resources of wetlands are attractive to numerous wildlife species including bats, fish, plants, and birds. In particular, migratory birds such as wood ducks (*Aix sponsa*), mallards (*Anas platyrhynchos*), and tree swallows (*Tachycineta bicolor*) will utilize open-water wetlands and are subject to potential impacts from contaminants. We recommend that project plans be designed to avoid impacts to the wetland habitats, particularly regarding contamination.

Based on the occurrence of wetlands near and adjacent to the site, certain activities may require a permit under Section 404 of the Clean Water Act. This process is administered by the U.S. Army Corps of Engineers. Their address is:

U.S. Army Corps of Engineers
Detroit District
P.O. Box 1027
Detroit, Michigan 48231

This information does not include concerns for other wildlife resources. Therefore, we recommend that you also contact the Indiana Department of Natural Resources, Division of Nature Preserves, and Division of Fish and Wildlife, concerning possible State-listed species, the salmonid fishery, and other resource concerns. Their addresses are:

Indiana Department of Natural Resources
Division of Nature Preserves
402 West Washington, Rm W267
Indianapolis, Indiana 46204

Indiana Department of Natural Resources
Division of Fish & Wildlife
402 West Washington, Rm W273
Indianapolis, Indiana 46204

We appreciate the opportunity to comment at this stage of project planning. If we can be of further assistance please contact Robin McWilliams-Munson at (812) 334-4261 ext. 207.

Sincerely,

Scott E. Pruitt
Field Supervisor

cc: Katie Smith, Division of Fish and Wildlife, IDNR, Indianapolis, IN
Jim Smith, IDEM, Indianapolis, IN
Wayne Faatz, IDNR, Indianapolis, IN
IDEM, Office of Land Quality, VRP, Indianapolis, IN

United States Department of the Interior

FISH AND WILDLIFE SERVICE

BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, IN 47403-2121
(812) 334-4261 FAX (812) 334-4273

May 14, 2002

Mr. John Klanke
APT, Limited
6910 North Main Street
Unit #17 - Building #2
Granger, Indiana 46530

Dear Mr. Klanke:

This is in response to your letter dated April 10, 2002 requesting information regarding the potential occurrence of critical habitat and/or Federally endangered and threatened species for a site in Michigan City, LaPorte County, Indiana. The site is located near the intersection of Karwick Road and Warnke Road in Section 27 of Township 38 North and Range 4 West.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

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THREATENED AND ENDANGERED SPECIES

This area described in your letter is within the range of the Federally endangered Indiana bat (*Myotis sodalis*) and the Federally threatened bald eagle (*Haliaeetus leucocephalus*). There are records of the Indiana bat within the Kankakee River system in LaPorte County. Suitable bat habitat probably exists along portions of the Little Kankakee River in the vicinity of the pumping station. There are also wintering records for the bald eagle in LaPorte County.

SPECIES INFORMATION

The Indiana bat uses woodlands during the summer when maternity colonies utilize trees with loose bark for roosting. These bats forage primarily over wooded stream corridors, although they have been collected in grazed woodlots, mature deciduous forests, and pastures with trees.

Bald eagles nest in close proximity to lakes, rivers, or reservoirs. They construct their nests near habitat ecotones, such as lakeshores, rivers, and timber management areas (clearcuts or selective cuts). Tolerance of human activity during the nesting season has been variable, but, ideally, human disturbance of eagles should be avoided. The bald eagle's food base from the watershed includes carrion, waterfowl, and especially fish.

In the event that Federally listed species are found within the project area or determined to be adversely affected by project plans, further coordination may be required under the Endangered Species Act of 1973, as amended.

OTHER SPECIES OF CONCERN

In addition to the above-mentioned species, there are two State-listed plant species found in the area. The variegated horsetail (*Equisetum variegatum*) is listed as endangered and the shining ladies' tresses (*Spiranthes lucida*) is considered rare.

Contamination from these sites may migrate to nearby wetlands, Trail Creek, Lake Michigan, or other areas of ecological significance. Pathways of migration may include leachate/ground water, surface water, and sediment. Under conditions that allow certain contaminants to accumulate in waterways, aquatic organisms can bioaccumulate these elements; consequently, elevated or toxic concentrations may be reached. We recommend that sampling and monitoring efforts address the potential for off-site migration of any possible contaminants.

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402 West Washington, Rm W273
Indianapolis, Indiana 46204

We appreciate the opportunity to comment at this stage of project planning. If we can be of further assistance please contact Robin McWilliams-Munson at (812) 334-4261 ext. 207.

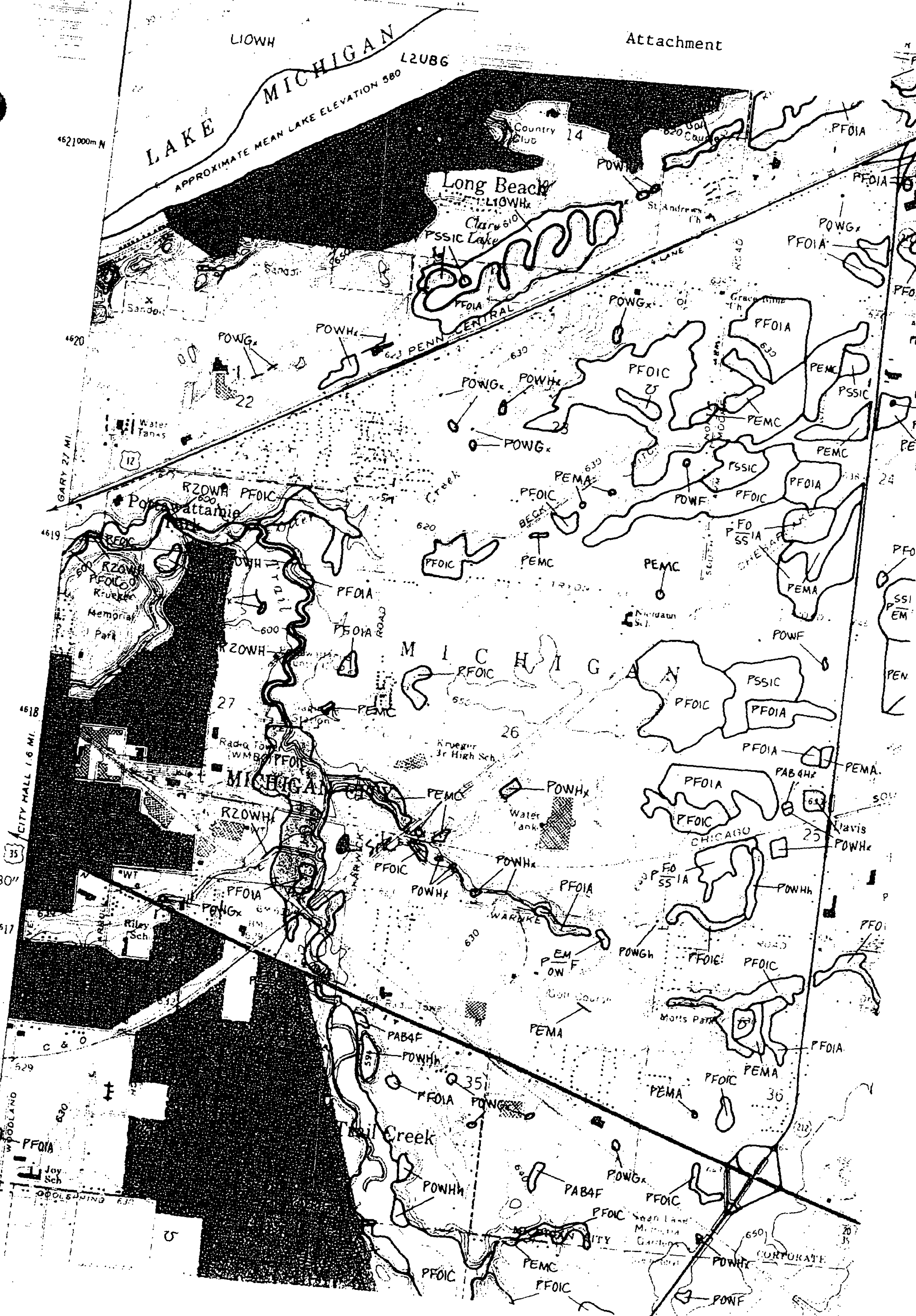
Sincerely,

Michael A. Litwin

Scott E. Pruitt
Supervisor

cc: Katie Smith, Division of Fish and Wildlife, IDNR, Indianapolis, IN
Jim Smith, IDEM, Indianapolis, IN
Wayne Faatz, IDNR, Indianapolis, IN
IDEM, Office of Land Quality, VRP, Indianapolis, IN

Attachment



LAKE MICHIGAN
APPROXIMATE MEAN LAKE ELEVATION 580
L1OWH
L2UBG
Country Club
Long Beach
L1OWHx
Clark Lake
PSSIC
PFO1A
PENN CENTRAL
POWGx
POWHx
PFO1C
PEMC
PSSIC
POWF
PEMA
Potawattamie Park
Krueger Memorial Park
RZOWH
Trail Creek
BECK
M I C H I G A N
Krueger Jr High Sch
MICHIGAN CITY
Water Tanks
Riley Sch
WARNKE
PAB4F
POWHh
POWGh
Golf Course
Motts Park
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Joy Sch
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GARY 27 MI.
42°30″
CORPORATE

Appendix D
Health & Safety Plan

APPENDIX D

HEALTH & SAFETY PLAN

APT, LIMITED

January 2004

HEALTH AND SAFETY PLAN

Karwick Road Landfill Site
Michigan City, Indiana

Prepared for:
City of Michigan City
Michigan City Economic Development Corp.
100 E. Michigan Blvd.
Michigan City, Indiana 46360

Prepared by:
APT, Limited
6910 N. Main Street, Unit 17
Granger, Indiana 46530

Project No. 312-01

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APPENDICES

1.0 INTRODUCTION

APT, Limited (APT) has been retained by the Michigan City Parks & Recreation Department and the Michigan City Economic Development Corp. (MCEDC), to conduct environmental assessment activities at an old landfill (Karwick) off of Karwick Rd in Michigan City, Indiana. The proposed activities will consist of soil and groundwater sampling. In addition, surface water samples and sediment samples will be collected from specified locations in Trail Creek and Cheney Run.

APT has prepared this Health and Safety Plan (HASP) in accordance with the Occupational Safety and Health Administration (OSHA) regulations found in 29 CFR 1910.120. This HASP provides the necessary procedures to protect human health and the environment, and is to be followed by all individuals involved in the assessment activities. The HASP presents the following information:

- Health and Safety Policy (Section 2.0)
- Key Personnel (Section 3.0)
- Safety and Health Risk Analysis (Section 4.0)
- Personnel Training Requirements (Section 5.0)
- Personal Protection Equipment (Section 6.0)
- Medical Surveillance Requirements (Section 7.0)
- Air Monitoring and Action Levels (Section 8.0)
- Site Control Measures (Section 9.0)
- Decontamination (Section 10.0)
- Emergency Response (Section 11.0)
- Sanitation (Section 12.0)
- Confined Space Entry (Section 13.0)
- Spill Containment Program (Section 14.0)
- Compliance Certification (Section 15.0)

2.0 HEALTH AND SAFETY POLICY

It is the policy of APT to provide a safe and healthy work environment for all employees and subcontractors. APT considers no phase of operation or administration to be of greater importance than injury and illness prevention. Safety takes precedence over expediency or shortcuts. At APT, it is believed that every accident and every injury is avoidable with proper training and planning. APT personnel will take every reasonable step to reduce the possibility of injury, illness, or accident.

This HASP describes the procedures that must be followed by all site personnel while at the former Karwick Road Landfill site. The provisions of this HASP are mandatory to all APT personnel, its contractors and visitors.

Work conditions and plans can change as operations progress. The Site Safety Officer (SSO) and Project Manager will provide written addenda to this HASP when changes warrant. Operational changes, which could affect the health or safety of personnel, the community, or the environment, will not be implemented without prior approval of the client and APT.

The following safe work practices will be strictly adhered to during site operations:

- At least one copy of this plan shall be available at the site at all times.
- At least one person trained in a minimum of basic first aid and CPR will be on site whenever site investigation and remediation activities occur. As an alternative, this requirement is satisfied when a 911 emergency responder can respond within five (5) minutes to the site.
- Emergency equipment shall be located in readily accessible uncontaminated locations.
- All personnel entering the site shall be thoroughly briefed on the hazards, equipment requirements, safety practices, emergency procedures, and communication methods.
- Personnel entrance and exit routes shall be planned and emergency escape routes designated. An evacuation route shall be reviewed at the site.
- Unfamiliar operations shall be discussed with affected personnel before beginning work.
- Operations will be stopped whenever visible dust emissions are generated. At a minimum, site-wetting practices shall be used to control dust emissions.
- Prompt action shall be taken if an inadvertent release of a hazardous material occurs.
- Work areas shall be illuminated with supplementary lighting, as necessary. Supplementary lighting may be necessary inside buildings, tanks at night, or in other poorly lit areas. Intrinsically safe lighting may be required in some areas.

- No food, beverages, or tobacco products shall be present, consumed or used in contaminated areas or potentially contaminated areas. Taking medication, smoking, or applying cosmetics are also prohibited. These activities are allowed only in the established clean room and clean areas.
- No smoking will be permitted for the duration of the project, except in designated areas.
- All personnel shall be required, as a minimum, to wash their face and hands with soap and water before eating, drinking, smoking or applying cosmetics. If deemed necessary, personnel shall also remove outer protective garments.
- Contaminated protective equipment, such as respirators, hoses, boots, etc., shall not be removed from the regulated area until it has been cleaned, or properly packaged and labeled.
- Removal of contaminated soil or debris from protective clothing or equipment by blowing, shaking, or any other means that disperses contaminants into the air is prohibited.
- Contaminated scrap waste, debris, and clothing shall be stored in tightly closed containers and located in well-ventilated areas.
- Legible and understandable precautionary labels will be affixed prominently to containers of contaminated scrap, waste, debris, and clothing.
- Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.
- All personnel should wear cotton, leather, or canvas work gloves during loading, unloading, moving, or manual lifting of uncontaminated equipment or materials. Gloves shall be sufficient to prevent cuts or bruises to the hands of individuals wearing them.
- APT employees and subcontractor personnel will use nearby sanitary facilities. No portable sanitary facilities will be provided.
- Fire extinguishers will be mounted on equipment as required. When there is a fire potential, fire extinguishers will be located in the adjacent area.
- All on-site personnel shall use the buddy system (working in groups of two or more). Buddies shall pre-arrange hand signals for communication. Buddies shall maintain visual contact with each other. Personnel must observe each other for signs of heat or cold stress or toxic exposure such as:
    - Changes in complexion and skin discoloration
    - Changes in coordination or demeanor
    - Excessive salivation and papillary response
    - Changes in speech pattern.

➢ Personnel shall also inform each other of non-visual effects potentially due to heat or cold stress or toxic exposure such as:

- Numbness of extremities or skin surface
- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory tract.

All visitors and personnel performing field activities must review and acknowledge that they understand and agree to comply with the HASP. Each individual must acknowledge this by signing the *Health and Safety Plan Acknowledgment* sign-off sheet to be provided to each person. Subcontractors must certify that their employees assigned to the remediation system construction are properly trained and have medical clearance by signing a *Contractor Certification* before starting work on the project.

A copy of the *Contractor Certification* as well as a *Site Health and Safety Plan Acknowledgment* sign-off sheet is included in Appendix A.

3.0 KEY PERSONNEL AND RESPONSIBILITIES

This section presents the key personnel involved with the field assessment at the former Karwick Road Landfill site and their responsibilities. Key personnel include the following:

- Site Safety Officer (SSO) — John E. Klanke
- Alternate SSO — Andrea M. DePoy
- Field Operations Leader (FOL) — Kelly R. Lechtanski
- Project Manager — John E. Klanke
- Client Representative — Tom B. Stevenson, Environmental Incorporated

3.1 ALL PERSONNEL

All personnel involved in the closure activities are responsible for continuous adherence to the health and safety procedures presented in the HASP while performing their work. No person shall work in a manner conflicting with the intent of or the inherent safety and environmental precautions expressed in these procedures. After due warnings, APT will dismiss from the site any person who violates the health and safety procedures presented in this HASP. APT employees are subject to progressive discipline and may be terminated for continued violations.

<u>THE PERSON MOST RESPONSIBLE FOR AN INDIVIDUAL'S HEALTH AND SAFETY IS THE EMPLOYEE HIMSELF.</u>

3.2 SITE SAFETY OFFICER (SSO)

The SSO is responsible for developing and coordinating the site-specific HASP and any addenda that may be required due to changing conditions or work scope. The SSO is the primary contact for regulatory agencies on matters of health and safety. Other SSO responsibilities include the following:

- General health and safety administration for the project;
- Determining the level of personnel protection equipment (PPE) required;
- Updating equipment or procedures based on information obtained during site operations;
- Establishing air monitoring parameters based on expected contaminants;
- Establishing employee exposure monitoring programs for the project, if necessary;
- Investigating and reporting accidents, illnesses, and other safety or environmental incidents, and implementing corrective action plans as necessary;
- Communicating key learnings from accidents, illnesses, and other incidents to the project team in order to prevent future accidents, illnesses, and other incidents from occurring; and
- Developing site-specific employee/community emergency response plans as required and based on expected hazards.

3.3 FIELD OPERATIONS LEADER (FOL)

The APT FOL supervises all APT activities at the site and is responsible for field implementation of the HASP. This includes communicating site requirements to all personnel, ensuring that field supervisors and subcontractors enforce all provisions of the plan, and consulting with the SSO and Project Manager regarding changes to the HASP. Other responsibilities include:

- Being familiar with this HASP and APT policies and procedures;
- Enforcing the HASP and other safety regulations;
- Stopping work as required to prevent injury and unsafe acts;
- Determining evacuation routes, establishing and posting local emergency telephone numbers and arranging emergency transportation;
- Assuring that the respiratory protection program is implemented;
- Determining that all site personnel and visitors have received the proper training and medical clearance prior to entering the site;
- Establishing work, decontamination and support zones;
- Presenting on-site safety meetings and maintaining attendance logs and records;
- Assuring that decontamination procedures meet established criteria; and
- Determining that there is a qualified first aid trained person on-site.

3.4 PROJECT MANAGER

The Project Manager is ultimately responsible for determining that all project activities are completed in accordance with requirements set forth in the HASP.

3.5 DRILL CREW MEMBERS/SAMPLE TEAM MEMBERS

Drill crew and sample team members will be responsible for understanding and complying with the requirements of the HASP. Each member will be expected to have the experience and training necessary to perform their job in a safe manner. Each member will be responsible for limiting the exposure of site contaminants and decontamination chemicals to other field personnel. Personnel will not "sniff" or touch samples or potentially contaminated material (e.g., soil, groundwater) without wearing the appropriate PPE.

3.6 SUBCONTRACTORS

On-site subcontractors and their personnel are responsible for understanding and complying with all site requirements and procedures established in this HASP as a minimum.

3.7 VISITORS

Visitors are required to be familiar with and comply with the provisions of this HASP. Visitors are required to check in with the SSO or FOL before entering the site, and will be briefed on site conditions and requirements. Visitors will then be required to review and sign the HASP. Visitors are responsible for their own health and safety, completing tasks in a safe manner, and reporting any unsafe acts or conditions to the SSO or FOL. Personnel will monitor themselves and their fellow employees for signs and symptoms of heat/cold stress and chemical exposure.

4.0 SAFETY AND HEALTH RISK ANALYSIS

This section discusses the potential safety and health risks associated with the closure activities. The discussions are broken into physical, chemical, and biological hazards.

4.1 PHYSICAL HAZARDS

Physical hazards are associated with every field project and require preventative measures to reduce the risk of injury to personnel. Physical hazards include the following:

- Heavy equipment
- Hand tools
- Slip, trip, fall
- Elevated work
- Electrical
- Underground utilities (e.g., electrical lines, buried pipelines)
- Overhead obstructions (e.g., electrical lines, pipe racks, overhangs)
- Deterioration of building
- Manual lifting
- Heat and cold stress
- Physical exertion
- Noise

The primary physical hazards associated with this project are buried and exposed debris including glass, metal, concrete rubble, and household refuse/garbage (slip, trip, and fall hazards). There is also the possibility that hazardous materials may have been disposed at the site given the presence of partially buried drums and the slightly impacted subsurface soils in one area. Lastly, there are potential hazards associated with working with and around heavy equipment (*e.g.*, drilling rigs) and hand tools, noise, and underground utilities along a right-of-way on the south side of the site. Personnel will also monitor for heat and cold stress signs and symptoms. Proper precautions and preventative measures will be taken to prevent injury to personnel and damage to facility structures and utilities that could potentially result from these hazards.

4.2 CHEMICAL HAZARDS

Chemical hazards result from the exposure to toxic and hazardous materials by any of the following means:

- Inhalation of vapors, particulates, aerosols, or fumes;
- Ingestion of soil, water, air, food, or drink containing toxic or hazardous materials;
- Direct skin contact with toxic or hazardous materials; and
- Absorption of toxic or hazardous materials through the skin upon contact.

The principal chemical hazards associated with this project are related to the potential exposure of man-made chemicals and metals in the soil and groundwater. Individual constituents may include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. However, these compounds are not anticipated to be present in amounts sufficient to be a cause for concern. The National Institute of Occupational Safety and Health's (NIOSH) *Pocket Guide to Chemical Hazards* (June 1994 or later addition) is to be referred to for a summary of exposure limits, chemical/physical properties, personal protection equipment (PPE) requirements, and health hazards for the constituents of concern.

4.3 BIOLOGICAL HAZARDS

Biological hazards typically encountered during construction activities include the following:

- Exposure to biological agents and pathogens (e.g., viral, bacterial, fungal, parasitic);
- Poison ivy, sumac, and oak;
- Insect and animal bites that may be poisonous or carry pathogens; and
- Insufficient personal hygiene practices.

No significant biological hazards are expected. However, the site is an abandoned landfill containing undefined waste, including household garbage. Therefore, proper precautions and preventative measures will be taken to prevent injury to personnel that could potentially result from biological hazards.

4.4 PROJECT SAFETY ANALYSIS

The project safety analysis (PSA) identifies potential safety, health, and environmental hazards and provides for the protection of personnel, the community and the environment. It is performed prior to beginning the project and continually throughout the project. The SSO and FOL must continually inspect the work site to identify hazards, which may be a hazard to site personnel, the community, or the environment. The SSO and FOL must be aware of any changing conditions and modify work procedures accordingly, and are responsible for contacting and informing the Project Manager of these changing conditions and modified work procedures. Written addenda to the HASP will be developed as necessary to account for changing conditions identified by the PSA and to update work, health, and safety procedures.

5.0 PERSONNEL TRAINING REQUIREMENTS

This section describes the general and specific training requirements for the field assessment activities at the former Karwick Road Landfill site.

5.1 GENERAL REQUIREMENTS

All field personnel are trained and certified to perform work associated with hazardous waste operations and emergency response (HAZWOPER) according to the OSHA regulations found in 29 CFR 1910.120. All field personnel receive a minimum of 40 hours of training off site, 3 days of actual field experience under the direct supervision of a trained and experienced HAZWOPER supervisor, and 8 hours annually of refresher training. A subcontractor's personnel must meet the same training requirements. Personnel, including subcontractors, whose activities are limited to non-hazardous activities, must complete 24 hours of training off site and 8 hours of onsite training.

A copy of each individual's training certificate is maintained with the project and personnel files. Subcontractors must provide certificates of training of each employee assigned to the project for the project file.

5.2 HAZWOPER TRAINING COURSE CONTENT

Following is a general list of topics covered in the 40-hour HAZWOPER training course:

- General site safety;
- Physical hazards (fall protection, noise, heat stress, cold stress);
- Names and titles of key personnel responsible for site health and safety;
- Safety, health and other hazards present at the site;
- Use of personal protective equipment;
- Work practices by which employees can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements;
- Recognition of symptoms and signs indicating overexposure to hazards;
- Worker Right-to-know;
- Routes of exposure to on site contaminants;
- Engineering controls and safe work practices;
- Components of the site health and safety program;
- Decontamination practices for personnel and equipment;
- Confined space entry procedures; and

- Emergency response plan.

5.3 SITE SAFETY ORIENTATION

Prior to beginning each field activity at the former landfill site, the SSO or FOL will brief all personnel and subcontractors on the site-specific requirements, hazards, and HASP.

5.4 DAILY ON-SITE SAFETY MEETINGS

The SSO or FOL will conduct an on-site safety meeting at the beginning of each day or shift once the job commences. The topics discussed at the safety meeting will include health and safety considerations for the day's activities, necessary PPE, problems encountered, and new operations. Attendance records and meeting notes will be maintained in the field notebook.

6.0 PERSONAL PROTECTION EQUIPMENT

This section describes the PPE requirements that have been selected for this project based on site characterization and analytical data, planned filed activities, site hazards, intended use, and duration of potential employee exposures. Maintenance and storage of PPE, decontamination, donning/doffing procedures, inspection and effectiveness monitoring, and limitations are also presented in this section. Level D PPE is the maximum anticipated level of protection for this project.

6.1 RESPIRATORY PROTECTION

The following guidelines will be followed at all times:

- The respiratory protection used on site will be in compliance with OSHA, 29 CFR 1910.134;
- Only properly cleaned, maintained, NIOSH approved respirators shall be used on site;
- Selection of respirators, as well as any decisions regarding upgrading or downgrading of respiratory protection, will be made by the Health and Safety Officer or his designee;
- Used air-purifying cartridges shall at a minimum be replaced at the end of each shift, or more frequently if flow through the cartridge falls off;
- Only personnel who have been trained to wear and maintain respirators properly shall be allowed to use respiratory protection;
- Respirator users shall be instructed in the proper use and limitations of respirators;
- Positive and negative pressure tests shall be performed each time the respirator in donned;
- If a person has difficulty in breathing during the fit test or during use, he or she shall be evaluated medically to determine if he can wear a respirator safely while performing assigned tasks;
- No person shall be assigned to tasks requiring the use of respirators if, based upon the most recent examination, a physician determines that the health or safety of that person will be impaired by respirator use;
- Contact lenses shall not be worn while using any type of respiratory protection;

- Excessive facial hair (beards) prevents proper face fit and effectiveness of respirators. Persons required to wear full-face or half-face respirators must not have beards, wide mustaches, goatees, extended sideburns, or Fu Manchu mustaches. All personnel wearing full-face or half-face respirators will be required to be clean shaven prior to each day's shift;
- Air-supplied respirators shall be assembled according to manufacturer's specifications. Hose length, couplings, valves, regulators, manifolds and all accessories shall meet American National Standards Institute (ANSI) and the manufacturer's requirements;
- Respirators shall be cleaned and sanitized daily after use;
- Respirators shall be stored in a convenient, clean and sanitary location;
- Respirators shall be inspected during cleaning. Worn or deteriorated parts shall be replaced;
- The SSO and FOL shall review the respiratory protection program daily to ensure employees are properly wearing and maintaining their respirators and that the respiratory protection is adequately protecting the employees; and
- The SSO and Project Manager shall evaluate the respiratory protection program monthly to ensure the continuing effectiveness.

6.2 LEVELS OF PROTECTION

The level of protection used in the work zone is based on site-specific information. Specific levels of protection will be changed whenever site conditions change. They can either be increased to the next higher level or decreased to the next lower level. The decision to change levels of protection will be made by the SSO and FOL. The SSO and FOL shall communicate decisions to upgrade or downgrade PPE levels to the Project Manager. The levels of protection are described below and in Section 8.0 of this document.

Level A PPE

Level A PPE is not anticipated to be required for this project.

Level B PPE

Level B PPE is not anticipated to be required for this project. Level B Protection will only be required if airborne, breathing-zone concentrations of VOCs are equal to the lower of either a time-weighted average of 5 ppmv over an 8-hour work day or a concentration of 1,000 parts per million (ppmv) over a five minute period, measured as total organic vapors with a portable organic vapor meter (OVM).

Although there is no information suggesting the disposal of chemical wastes at the site, the presence of partially buried drums at the site suggests the potential for chemical impacts. If hazardous materials were disposed at the site, it is APT's experience that petroleum products and waste solvents comprise the most likely types of contaminants that might be present.

Therefore, the 5 ppmv action criteria value represent five times the OSHA Permissible Exposure Limit (PEL) for benzene. Benzene is the target constituent anticipated to be most likely encountered at the site having the lowest TWA PEL.

The 1,000 ppmv action criteria represents five times the OSHA ceiling PEL of 200 ppmv for PCE and TCE, since waste solvents are a possibility at the site, and PCE and/or TCE are the solvents most likely to be encountered having the lowest OSHA ceiling PEL.

Since the OVM is incapable of distinguishing individual COCs, a conservative approach that is protective of worker exposure is to assume that benzene, or PCE/TCE, constitute 100% of the detected vapors.

A factor of five times the PEL was used because Level C PPE using a full-face, air-purifying respirator provides a protection factor of 10 for breathing zone concentrations. The designated action level of 5 ppmv TWA over an eight-hour work day and 1,000 ppmv over a five minute period (*i.e.*, five times the ceiling PEL of PCE) provides a safety factor to account for potential synergistic effects of multiple VOCs being present and the potential for not detecting peak concentrations in the breathing zone. The Project Manager will be notified when the decision is made to upgrade to Level B.

Level C PPE

Level C PPE is not anticipated to be required for this project. Level C PPE will be required if airborne, breathing-zone concentrations of VOCs are equal to the lower of either a TWA concentration of 0.5 ppmv over an eight-hour work day or a concentration of 100 ppmv over a five minute period, measured as total organic vapors with a portable OVM.

The former value represents one-half the OSHA Permissible Exposure Limit (PEL) for benzene. Benzene is the target constituent anticipated to be most likely encountered at the site having the lowest TWA PEL.

The latter value represents one-half the OSHA ceiling PEL of 200 ppmv for PCE and TCE, since waste solvents are a possibility at the site, and PCE and/or TCE are the solvents most likely to be encountered having the lowest OSHA ceiling PEL.

Since the OVM is incapable of distinguishing individual COCs, a conservative approach that is protective of worker exposure is to assume that benzene, or PCE/TCE, constitute 100% of the detected vapors. The Project Manager will be notified when the decision is made to upgrade to Level C PPE.

The factor of one-half of the PEL was selected in order to be protective of worker health by taking into account potential synergistic effects of multiple constituents being present and the potential for not detecting peak concentrations in the breathing zone. If Level C PPE becomes necessary, the following equipment will be used during the field activities at the site:

- Full-face, air-purifying respirators with combination organic vapor/HEPA filter (color-coded black and magenta or black and purple);
- Standard Tyvek® coveralls or equal, with taped at gloves and boots;
- Nitrile gloves with latex inner gloves;
- Steel-toed boots with rubber overboots; and
- Hard-hat.

Modified Level D PPE

Modified Level D PPE is not expected to be required for field work unless field observations indicate a need for dermal protection without respiratory protection, as determined by the SSO. The following equipment will be used for Modified Level D PPE:

- Disposable Tyvek® coveralls or equal taped at gloves and boots;
- Nitrile gloves with latex inner gloves;
- Steel-toed boots with rubber overboots; and
- Safety glasses and hard hat

Level D PPE

As a minimum, Level D PPE will be required for all field work, and this includes the following PPE:

- Standard work clothes or coveralls
- Leather work gloves when operating heavy equipment or hand tools, disposable latex gloves for sampling;
- Steel-toed boots;
- Safety glasses; and
- Hard hat when working around heavy equipment or in areas of the facility that requires hard hats.

Noise Protection

Earplugs will be worn by personnel working around heavy equipment if the noise level reaches 85 decibels in the work area.

6.3 DONNING AND DOFFING

All persons entering the immediate work area shall put on the required PPE according to established procedures in this plan to minimize exposure potential. When leaving the work area, PPE shall be removed according to these established procedures to minimize the spread of contamination.

Donning Procedures
The following donning procedure will be used:

1. Remove street clothes and store in a clean location.
2. Put on coveralls or work clothes.
3. Put on boots.
4. Put on gloves.
5. Put on remaining PPE, such as hard hat, safety glasses, respirator, etc.

Doffing Procedure
The following doffing procedure will be used for removing PPE:

1. Before leaving work areas, rinse potentially contaminated mud and debris from PPE.
2. Remove overboots.
3. Remove outer gloves.
4. Remove hood and coveralls.
5. Remove respirator.
6. Remove inner gloves.
7. Clean reusable PPE.
8. Wash hands and face thoroughly.

All disposable equipment, garments, and PPE shall be bagged in trash bags and placed into properly labeled containers (e.g., trash bin or drums), and disposed of properly.

7.0 MEDICAL SURVEILLANCE REQUIREMENTS

This section describes the medical surveillance program that APT intends to implement.

7.1 PHYSICAL EXAMINATION

All field personnel will have successfully completed a periodic physical examination and been given medical clearance from the examining physician that they are clear for HAZWOPER work. The physical examination has been designed to meet the requirements of the OSHA regulations found in 29 CFR 1910.120. A thorough medical surveillance program examination consists of:

- Medical and occupational history questionnaire;
- Physical examination;
- Complete blood count with differential;
- SMAC 24;
- Urinalysis;
- Chest x-ray;
- Pulmonary function test;
- Audiogram;
- Drug and alcohol screening; and
- Visual acuity.

The following information should be provided to the examining physician:

- Description of employee's duties;
- Anticipated chemical and asbestos exposure and levels;
- Description of the personal protective equipment to be used; and
- Information from previous medical exams.

Contractors will certify that all their employees have successfully completed a physical examination by a qualified physician on the Certification Form. The physical examinations shall meet the requirements of 29 CFR 1910.120, and 29 CFR 1910.134. Contractors will supply copies of the medical examination certificate for each onsite employee.

7.2 MEDICAL RECORDS

Medical and personal exposure monitoring records will be maintained according to the requirements of 29 CFR 1910.120 and shall be kept for a minimum of 30 years. Employee confidentiality shall be maintained.

8.0 AIR MONITORING AND ACTION LEVELS

Air monitoring will be conducted using "real-time" or "direct-reading" instrumentation, due to the potential exposure to VOCs during the field activity. Air in the work area and environs will be continuously monitored during drilling operations or any other operation where VOCs are likely to be released. The breathing zones of personnel with the highest probability of exposure to VOCs and general work area will be monitored using a portable organic vapor meter (OVM) equipped with a photoionization detector (PID). A portable OVM measures the total concentration of organic vapors in ambient air. When not actively being used for testing a specific location, this instrument will be placed near the highest anticipated potential contamination and continuously operated. Measurements will be periodically recorded in the field notebook.

Real-time measurements of total organic vapor concentrations will be used by the SSO and FOL to evaluate and decide whether to upgrade the PPE level. Action levels for total organic vapor concentrations in the breathing zone are as follows:

- Upgrade from Level D PPE to Level C PPE: 0.5 ppm TWA over 8-hr work day; or 100 ppm over 5-minute period.
- Upgrade from Level C PPE to Level B PPE: 5 ppm TWA over 8-hr work day; or 1,000 ppm over 5-minute period.

These action levels must be sustained in the breathing zone for longer than the specified times before upgrading. This prevents site personnel from having to unnecessarily don PPE.

The action levels are based on the VOC constituents anticipated to be in the breathing zone. The primary potential indicator constituents of concern are benzene, TCE, and PCE, because they are the constituents most likely to be present at the site, having the lowest PELs, which could potentially volatilize and be present in the breathing zone. The OSHA PEL for benzene is 1 ppm over an 8-hour work day. The OSHA ceiling PEL for TCE and PCE is 200 ppm over a five-minute period.

The action levels for upgrading from Level D PPE to Level C PPE of 0.5 ppm over an 8-hour work day and 100 ppm over a 5-minute period were selected because they are equal to one half of the TWA and ceiling PELs for benzene and PCE/TCE, respectively and are protective of potential synergistic effects of multiple constituents being present and the potential for not detecting peak concentrations in the breathing zone. The action levels for upgrading from Level C PPE to Level B PPE of 5 ppm over an 8-hour work day and 1,000 ppm over a 5-minute period were selected because they are equal to five times the TWA and ceiling PELs for benzene and PCE/TCE, respectively, and are protective of potential synergistic effects of multiple constituents being present and the potential for not detecting peak concentrations in the breathing zone.

The portable OVM will be calibrated daily using the manufacturer's specified procedures. Calibration may be done more frequently at the discretion of the SSO and FOL.

9.0 SITE CONTROL MEASURES

Site control requires establishing specific measures to prevent unauthorized entry onto the work areas and to protect all personnel entering the work areas from recognized safety and health hazards. The measures described in this section are mandatory.

9.1 WORK ZONES

The SSO and FOL will establish work zones for the project based on the location of contamination, investigation activities, accessibility, and site control. These work zones include the exclusion zone, contaminant-reduction zone, and support zone, and must be clearly marked and defended against unauthorized entry. The work zones are described in the following sections. A map is not provided since work zones will be moved with the drilling rig as points are advanced at different locations.

Exclusion Zone

An exclusion zone is the area where contamination is suspected or known to be present, or where significant physical, chemical, or biological hazards are present. This zone has the highest potential for exposure to the contaminants by inhalation and direct contact or for injury to occur as the result of a significant physical, chemical, or biological hazards. This area will be clearly marked at the site using safety fencing or other types of barriers or markers, if determined to be necessary by the SSO or FOL.

The SSO and FOL may change the exclusion zone based on professional judgment and data collected in the field. For example, if OVA measurements are recorded outside the existing exclusion zone, the SSO or FOL should increase the size of the exclusion zone to the point where no OVA measurements are recorded outside the exclusion zone.

Contaminant-Reduction Zone

The contaminant reduction zone will be clearly marked, if necessary, and established in a convenient, easily accessible area where inadvertent entry by facility employees or other persons is minimized. Equipment and personnel decontamination activities will take place in this zone. The SSO and FOL may change the location of this zone based on professional judgment and accessibility.

Support Zone

Support zones are established in uncontaminated areas and are used for the storage of supplies and general administrative functions. Work breaks will be taken in this zone, which includes the entire facility outside of the exclusion and contaminant-reduction zones.

9.2 SITE ENTRY

The Project Manager or FOL may grant authorization to enter the work areas. Access to contaminated work areas is regulated and limited to only authorized and properly trained personnel. Representatives from regulatory agencies will be permitted to enter the work areas if the client representative has authorized this action, they are properly trained, and the HASP and other site-specific requirements are followed. Representatives of the news media and other visitors must receive authorization from the client, and must be accompanied by the Project Manager, SSO, or FOL.

9.3 SITE ORIENTATION

The SSO or FOL will brief all personnel entering the work areas on the requirements of the HASP and inform them of potential site health and safety hazards and procedures specific to this site. All personnel shall acknowledge this briefing by signing the acknowledgment form contained in the HASP. This briefing shall be further documented in the field notebook or other appropriate log.

9.4 DOCUMENTATION OF CERTIFICATES

Personnel entering the site to work shall have satisfied the medical and HAZWOPER training requirements of the OSHA regulations found in 29 CFR 1910.120. The project file shall contain copies of certificates documenting status for all on-site personnel. Personnel not entering the work zones need not meet the above requirements. The Project Manager or SSO shall accommodate requests from regulatory agency representatives to review this documentation. All visitors must present documentation of current training and medical status before being granted authorization to enter the work zone.

9.5 ENTRY LOG

The SSO and FOL will keep a daily roster in the field notebook or other appropriate log of all on-site personnel and visitors including the time of entry into and exit from the site for each person.

10.0 DECONTAMINATION

Field personnel and equipment decontamination is necessary to minimize the potential for spreading contamination outside of the exclusion and contaminant-reduction work zones. Decontamination procedures are presented in this section for Level D and C PPE, equipment, and emergency decontamination of injured persons.

10.1 LEVEL D PPE DECONTAMINATION

Work completed in Level D PPE is not anticipated to result in gross contamination of personnel, so decontamination requirements are minimal. Level D PPE decontamination procedures only consist of cleaning off monitoring equipment and hand tools, bagging and containerizing disposal equipment and PPE, containerizing wash and rinse water, and implementing good personal hygiene practices prior to leaving the contaminant-reduction zone.

10.2 LEVEL C AND MODIFIED LEVEL D PPE DECONTAMINATION

Work completed in Level C and Modified Level D PPE has the potential to result in gross contamination of personnel, so decontamination requirements are more extensive than work performed in Level D PPE. Decontamination procedures are presented in this section.

Step 1: Segregated Equipment Drop
Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in separate containers with plastic liners. Each piece of equipment will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination.

Equipment: *Various sized containers*
Plastic liners
Plastic drop cloths.

Step 2: Reusable Boots, Gloves, and Garment Wash and Rinse
Scrub boots, gloves, and chemical-resistant suit with decontamination solution or detergent/water. Rinse gloves, boots, and garment with clean water into plastic bucket.

Equipment: *Two containers (30- to 50-gallons)*
Detergent/ Water
Scrub brushes, long-handle.

Step 3: Disposable Boots and Gloves Removal
Remove boots and gloves with accompanying tape. Dispose in a plastic-lined container.

Equipment: *One container (30 to 50-gallon)*
Plastic liner
Bench or stool.

Step 4: Canister/Cartridge Change

If a worker leaves the contaminated work zone to change canister/cartridge on his/her respirator, this is the last step in the decontamination procedure. Once the worker's canister/cartridge is exchanged, the outer gloves and boot covers are donned with joints taped. The worker may then return to the contaminated work zone. All used canisters or cartridges will be disposed of at the end of the work day and fresh ones installed before start of work.

Equipment: *Respirator canisters/cartridges*
Tape
Extra gloves
Boot covers (if worn).

Step 5: Boots, Gloves, and Outer Garment Removal

Remove boots, gloves (inner), and outer garment. The outer chemical-resistant garment and inner gloves should be deposited in a plastic-lined container.

Equipment: *Container (30- to 50-gallons)*
Bench or stool
Plastic liners.

Step 6: Respiratory Protection Removal

Remove the face piece respirator, deposit used cartridge in a plastic-lined container, and wipe the face piece with clean water and paper towels.

Equipment: *Container (30- to 50-gallons)*
Plastic liners
Paper towels
Detergent solution
Rinse water.

Step 7: Field Wash and/or Decontamination Unit

Wash hands and face and shower as soon as possible.

Equipment: *Water*
Soap
Wash basins/buckets.

10.3 EQUIPMENT DECONTAMINATION

Any item taken into an exclusion zone must be assumed to be contaminated and must be carefully inspected and/or decontaminated prior to the item leaving the area. All contaminated vehicles, equipment, and materials will be cleaned and decontaminated to the satisfaction of the SSO and FOL or containerized prior to leaving the site. Verification that equipment has been adequately decontaminated or containerized is the responsibility of the SSO and FOL. The ultimate responsibility that these procedures are followed still resides with the Project Manager.

In a designated area within the contaminant-reduction zone, an equipment decontamination station will be constructed for the removal of gross contamination from all vehicles and equipment leaving the work areas. All reusable PPE and materials shall be decontaminated and reconditioned for reuse prior to final removal from the work zone.

Decontamination will take place on the equipment decontamination pad established by APT. Special attention will be paid to the removal of material on and within the undercarriage, tracks, and sprockets of track-mounted equipment, and the undercarriage, tires, and axles of trucks and rubber-tired mounted equipment. High-pressure spray washers and/or steam cleaners will be used to decontaminate heavy equipment.

Instruments used in the exclusion zone are to be protected from contamination to the extent feasible. Decontamination of instruments is to be conducted using appropriate solvents (e.g., alcohol, hexane, etc.) so that the instruments are visually clean. Tools and items, for which decontamination is difficult or impossible to verify, will remain on site until project completion for subsequent packaging and proper disposal (for example, items such as lumber, rope, and disposable clothing).

The following is a list of equipment needed for decontamination:

- Plastic garbage barrels;
- Liners for garbage barrels;
- Galvanized steel basins;
- Alconox® (or equivalent) detergent concentrate;
- Deionized or distilled water;
- Hand pump sprayers;
- Long handle soft bristle brushes;
- Large sponges;
- Cleanser for respirators;
- Plastic bags;
- Liquid detergent and paper towels;
- Rolls of plastic; and
- High pressure spray washers and/or steam cleaners.

10.4 EMERGENCY DECONTAMINATION OF INJURED PERSONS

Injured personnel will be handled in a manner that provides maximum medical response to the injured person, prevents injury to others, and prevents contamination to emergency personnel and the hospital. Injured personnel who are in potentially contaminated work zones should be removed if at all practical (without further injuring the person). Decontamination consisting of at least gross removal of contaminants should be carried out prior to the injured person leaving the site.

In some situations movement of the injured person, removal of PPE, or decontamination may result in further injury. Under these circumstances, site personnel will provide first aid and comfort to the victim to the degree possible (e.g., providing a sun shield by suspending a space blanket or tarp over them) while awaiting instructions from emergency personnel.

Injuries in the exclusion zone may require modifying many of the site health and safety procedures. In these situations, personnel will render aid immediately, contact members of the project management staff, and provide full information and assistance to emergency personnel including providing PPE and decontamination where necessary.

11.0 EMERGENCY RESPONSE

This section describes the emergency response procedures in the event of an emergency or other incident occurring during field activities.

11.1 EMERGENCY CONTACTS

In the event of an emergency or other incident, the following individuals shall be contacted as soon as possible in the order they are presented. These individuals should only be contacted once the emergency situation is stabilized (e.g., ambulance has been contacted for injured persons, actions are taken to prevent further injury or damage to property).

FIELD OPERATIONS LEADER (FOL):	**Kelly R. Lechtanski**	**(574) 257-8196**
SITE SAFETY OFFICER (SSO):	**John E. Klanke**	**(574) 257-8196**
APT PROJECT MANAGER:	**John E. Klanke**	**(574) 257-8196**
ALTERNATE APT CONTACT:	**Andrea DePoy**	**(574) 257-8196**
CLIENT REPRESENTATIVE:	**Thomas B. Stevenson**	**(219) 462-7576**
CLIENT CONTACT:	**Tony Rodriguez**	**(219) 873-1211**

Organizations and phone numbers that may also be contacted in case of an emergency are as follows:

POLICE	**911**
FIRE DEPARTMENT	**911**
AMBULANCE	**911**
HOSPITAL, EMERGENCY (St. Anthony Memorial Health Centers, 301 West Homer, Michigan City, IN)	**(219) 877-1616**
POISON INFORMATION CENTER	**(800) 382-9097**
NATIONAL RESPONSE CENTER (Spill Reporting)	**(800) 424-8802**

11.2 GENERAL

The SSO and FOL will establish evacuation routes and assembly areas for each work area. All personnel entering a work area will be informed of these routes and assembly areas. If the work area is large and the evacuation routes are not clear, a site plan will be made marking the evacuation routes and will be posted at conspicuous locations.

Each work area will be evaluated for the potential for fire, explosion, chemical release or other catastrophic events. Based on previous site characterization and remediation activities, chemical releases and explosions are not likely to occur. Unusual events, activities, chemicals and conditions will be reported to the Project Manager/Field Operations Leader.

The following emergency equipment will be available:

- Large industrial first aid kits;
- Emergency oxygen with inhalator mask and resuscitation mask with one-way valve;
- An adequate supply of disposable latex gloves in sterile condition; and
- 10 to 20 lbs. A:B:C dry chemical fire extinguishers.

The SSO and FOL will document all health and safety incidents that occur during the remediation system construction. All incidents will be dealt with in a manner to minimize adverse health risks to site workers, the environment and the local community. If an incident occurs, the following procedure will be followed:

- First aid or other appropriate initial action will be administered by properly trained personnel who are closest to the incident. This assistance will be conducted in a manner to ensure that those rendering assistance are not placed in a situation of unacceptable risk.
- If an injury to a worker is chemical in nature (e.g., overexposure), the following first aid procedure is to be instituted:
  - ***Eye exposure*** - if contaminated soils or liquids get into the eyes, wash eyes immediately at the emergency station using large amounts of potable water and lifting the lower and upper lids occasionally. Wash for at least 15 minutes. Obtain medical attention immediately.
  - ***Skin Exposure*** - if contaminated solids or liquids get on the skin, promptly wash the contaminated skin using soap or mild detergent and water for at least 15 minutes. Obtain medical attention immediately when exposed to concentrated solids or liquids.

- All workers on site are responsible for conducting themselves in a mature, calm manner in the event of an incident event. All personnel must conduct themselves in a manner to avoid spreading the danger to themselves and to other workers.
- All incidents will be promptly reported to the SSO and FOL. The SSO or FOL is responsible for coordinating the emergency response in an efficient, rapid, and safe manner, and communicating all information to the Project Manager.
- The SSO will be the site emergency coordinator and will evaluate each incident to determine the extent of the incident and the need for outside assistance. Outside assistance will be requested as needed. The SSO will act as liaison between responding agencies and site personnel.
- If an injured person can be removed, he or she will be removed from the source of contamination. Decontamination procedures, additional first aid, or preparation for transportation will be conducted at a safe distance from the work area.
- If the SSO determines that evacuation is necessary, all personnel will assemble in the Support Zone and be accounted for at that time.
- The SSO has the authority to commit resources as needed to contain and control released material and to prevent its spread to off site areas.

11.3 SAFETY SIGNALS

Vehicle, tractor, or portable horns will be used for safety signals as follows:

- 1 Long Blast: Emergency evacuation
- 2 Long Blasts: Clear working area around powered or moving equipment

11.4 MEDICAL EMERGENCY

Paramedics will be summoned without delay in the event of a medical emergency. The emergency coordinator will stay on the line with the 911 operator until the operator hangs up. If an individual is injured and is ambulatory or not in critical condition, they can be driven to the nearest hospital. The directions to the hospital are as follows:

Go south on Karwick Rd, which will turn into Warnke Rd after left-hand bend in road. Proceed east on Warnke Rd and take first right hand turn – this is also Warnke Rd. (there will to two options travel down Warnke Rd, east and south - go south). Proceed south on Warnke Rd to US-35. Turn right onto US-35 N—proceed northwest –US-35 N becomes US-12. Turn left onto US-421 S – US-421 S becomes Washington St. Proceed on US-421 S/Washington St, which becomes US-421 S. Turn right on US-421/Franklin St. Proceed on US-421/Franklin St to W Homer St. Turn right onto W Homer St and proceed to hospital and follow the hospital signs.

11.5 REPORTING INJURIES AND ILLNESSES

Personnel will immediately report all injuries and illnesses as soon as possible to the SSO or FOL. The SSO or FOL will immediately contact the Project Manager as soon as the situation has been stabilized, and will submit a *Report of Injury* to the Project Manager within 24 hours of the occurrence. If there is any indication that an injury or illness is work-related, the SSO or FOL will also submit a *Report of Injury* to the Project Manager within 24 hours after being notified by the person.

12.0 SANITATION

This section describes the sanitation procedures to be followed.

12.1 POTABLE WATER

An adequate supply of potable water shall be provided on the site. Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap. Disposable cups will be supplied. A sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

12.2 NON-POTABLE WATER

There are no outlets for non-potable water on the former Karwick Road Landfill site. Therefore, there shall be no cross connection (open or potential) between potable and non-potable water systems.

12.3 TOILET FACILITIES

Personnel will use the toilet facilities at another location off site.

12.4 FOOD HANDLING

With the exception of Gatorade and water, food will only be stored and consumed in designated areas outside of the exclusion and contaminant reduction zones. The SSO will designate areas for dispensing of Gatorade and water.

13.0 CONFINED SPACE ENTRY

Confined space entry will not be required for this project. If it is determined to be necessary during the project, an addendum to this HASP will be prepared that will specify the confined-space entry procedures. No confined space entry will be done until the addendum is completed, personnel have been properly trained and briefed on the work scope and confined space entry procedures, appropriate ambient air measurements are completed within the confined space, and a confined space entry permit is obtained.

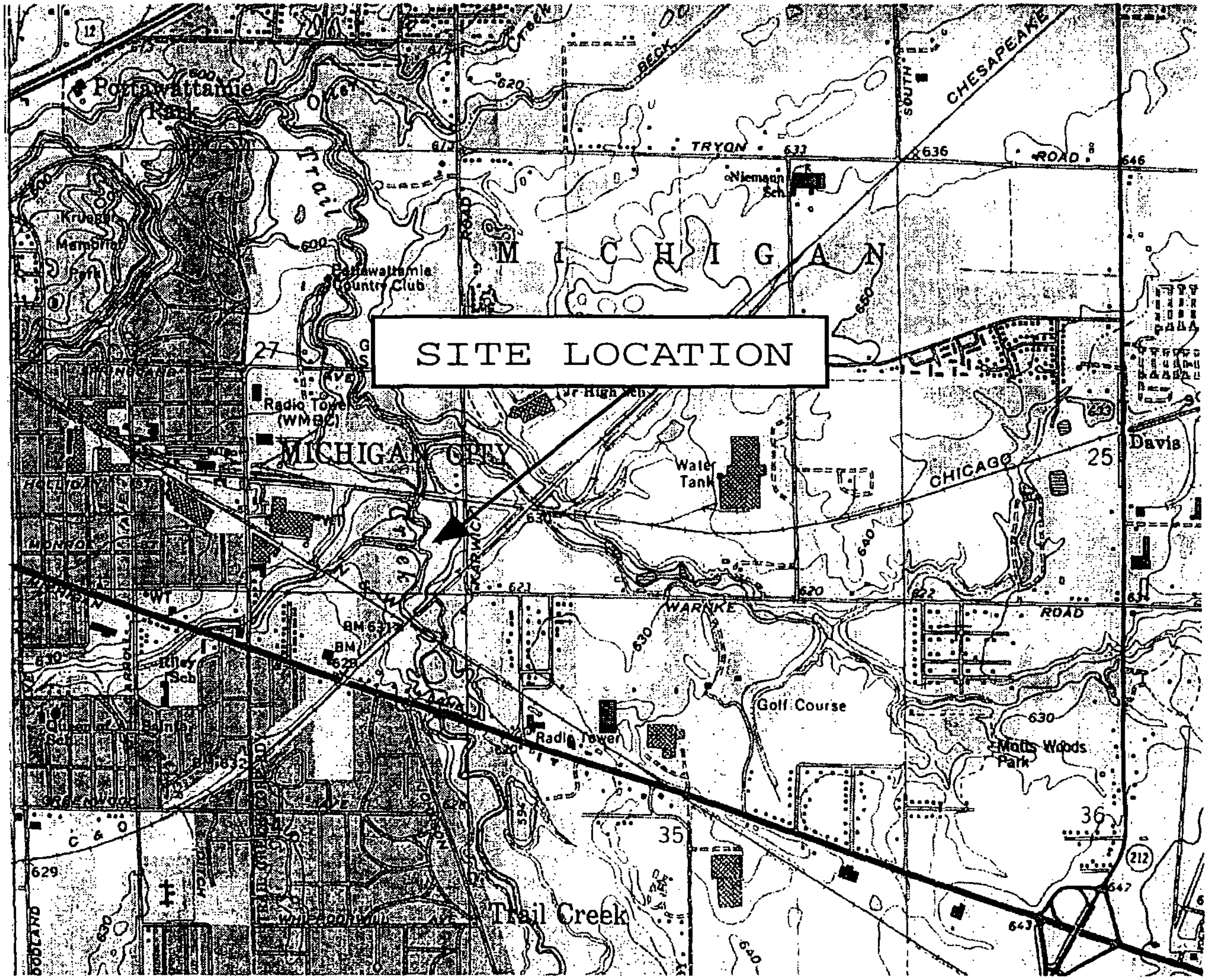
14.0 SPILL CONTAINMENT PROGRAM

No spills of hazardous materials are expected to occur during the site activities based on the project scope not involving the handling of significant quantities of hazardous materials that would require reporting. The emergency contacts listed in Section 11 of this document are to be notified at the earliest safe opportunity if such a situation occurs.

15.0 COMPLIANCE CERTIFICATION

All visitors and personnel performing field activities must review and acknowledge that they understand and agree to comply with the HASP. Each individual must acknowledge this by signing the *Health and Safety Plan Acknowledgment* sign-off sheet to be provided to each person. Subcontractors must certify that their employees assigned to the site activities are properly trained and have medical clearance by signing a *Contractor Certification* before starting work on the project.

A copy of the *Contractor Certification* as well as a *Site Health and Safety Plan Acknowledgment* sign-off sheet is included in Appendix A.



USGS QUAD MICHIGAN CITY EAST, IN 7.5 MINUTE 1969 (REV. 1980)

APT	PROPERTY OF APT THIS DOCUMENT WAS PRODUCED BY APT AS AN INSTRUMENT OF SERVICE AND REMAINS THE PROPERTY OF APT. THIS DOCUMENT IS CONFIDENTIAL AND MAY NOT BE REUSED OR MODIFIED FOR MORE THAN THE CLIENT'S INTERNAL USE WITHOUT THE PRIOR WRITTEN AUTHORIZATION OF APT. ALL RIGHTS OF DESIGN ARE RESERVED.	TASK: 1 DWG: 312.1.F1.SL DATE: 9-12-02 DWG BY: AB	M. C. PARKS & RECREATION MICHIGAN CITY, IN PREPARED FOR M. C. PARKS & RECREATION MICHIGAN CITY, IN	FIGURE 1 SITE LOCATION MAP

APPENDIX A

CONTRACTOR CERTIFICATION

CONTRACTOR CERTIFICATION

I, ____

as an agent of ____, do hereby certify that the following employees have successfully completed a 40 hour training course which complies with the provisions of 29 CFR 1910.120, and respiratory protection training which complies with 8 CFR 5144. Each employee has successfully completed a medical examination that complies with the above regulations.

Individual copies of certification of successful completion of the required training and medical examination are attached for each employee.

______________________________ ______________________

Signature Date

SITE HEALTH AND SAFETY PLAN ACKNOWLEDGMENT

I have read, understand, and agree to abide by the provisions as detailed in this Site Specific Health and Safety Plan prepared by APT, Limited. Failure to comply with these provisions may lead to disciplinary action and/or my dismissal from the work site.

Printed Name	Signature	Date

APPENDIX B

EXPOSURE GUIDELINES

EXPOSURE GUIDELINES

The following are exposure guidelines for selected chemicals that may be encountered in soils and/or groundwater at the site.

Acetone PEL:

OSHA - 1000 ppm
NIOSH - 250 ppm
IDLH - 2,500 ppm (10% LEL)

Benzene PEL:

OSHA – 1 ppm
NIOSH – Ca 0.1 ppm
IDLH – Ca 500 ppm

2-Butanone (MEK) PEL:

OSHA – 200 ppm
NIOSH – 200 ppm
IDLH – 3,000 ppm

1,1-Dichloroethane PEL:

OSHA – 100 ppm
NIOSH – 100 ppm
IDLH – 3,000 ppm

1,1-Dichloroethene PEL:

OSHA – NA
NIOSH – NA
IDLH - NA

1,2-Dichloroethene (total) PEL:

OSHA - 200 ppm
NIOSH - 200 ppm
IDLH - 1,000 ppm

Ethylbenzene PEL:

OSHA - 100 ppm skin
NIOSH - 100 ppm
IDLH - 800 ppm

Methylene Chloride PEL:

OSHA – 25 ppm
NIOSH – Ca
IDLH – Ca 2,300 PPM

Naphthalene PEL:

OSHA – 10 ppm
NIOSH – 10 ppm
IDLH – 250 ppm

Tetrachloroethene (PCE) PEL:

OSHA - 100 ppm
- C 200 ppm
- 300 ppm (5-min. max peak in any 3 hrs)
NIOSH - Ca
IDLH - Ca 150 ppm

Toluene PEL:

OSHA – 200 ppm
- C 300 ppm
- 500 ppm (10-min max peak)
NIOSH – 100 ppm
IDLH – 500 ppm

1,1,1-Trichloroethane PEL:

OSHA - NA
ACGIH - NA
IDLH - NA

1,1,2-Trichloroethane PEL:

OSHA – 10 ppm (skin)
NIOSH – Ca 10 ppm (skin)
IDLH – Ca 100 ppm

Trichloroethylene PEL:

OSHA - 100 ppm
- C 200 ppm
NIOSH - Ca
IDLH - Ca 1,000 ppm

1,2,3-Trimethylbenzene; 1,2,4-Trimethylbenzene; and 1,3,5-Trimethylbenzene PEL:
OSHA – none
NIOSH – 25 ppm
IDLH - NA

o-Xylene PEL:

OSHA - 100 ppm
NIOSH - 100 ppm
IDLH - 900 ppm

m-Xylene PEL:

OSHA – 100 ppm
NIOSH – 100 ppm
IDLH – 900 ppm

p-Xylene PEL:

OSHA – 100 ppm
NIOSH – 100 ppm
IDLH – 900 ppm

Notes:
Unless other wise noted, OSHA PEL values are time-weighted average (TWA) concentrations that must not be exceeded during any 8-hour work shift of a 40-hour work week.

NIOSH PEL values are time-weighted average (TWA) concentrations that must not be exceeded during any 10-hour work shift of a 40-hour work week.

A short-term exposure limit (STEL) is a 15-minute TWA exposure that should not be exceeded at any time during the work day.

C = A ceiling value that should not be exceeded at any time during the work day.

Ca = A suspected or known carcinogen. A PEL value may not be available.

NA = No value available.

APPENDIX E

QUALITY ASSURANCE PROJECT PLAN

APT, LIMITED

January 2004

QUALITY ASSURANCE PROJECT PLAN

Former Karwick Road Landfill Site
Michigan City, Indiana
VRP ID No. 6020118

Prepared For:
Michigan City Economic Development Corporation
100 East Michigan Boulevard
Michigan City, Indiana 46360

Prepared By:
APT, Limited
6910 North Main Street, Unit 17
Granger, Indiana 46530
(574) 257-8196

Project No. 312-01

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CONTENTS - continued

TABLES

LIST OF ABREVIATIONS AND ACRONYMS

APT	APT, Limited
AST	Above Ground Storage Tank
ASTM	American Society of Testing Materials
COC	Chain-of-Custody
DQA	Data Quality Assessment
DQO	Data Quality Objective
EI	Environmental Incorporated
ESA	Environmental Site Assessment
HASP	Health and Safety Plan
MCEDC	Michigan City Economic Development Corporation
mg	milligram
ml	milliliter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NFA	No Further Action
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OVM	Organic Vapor Meter
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PPL	Primary Pollutant List
ppm	parts per million
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
QLs	Quantitation Limits
REC	Recognized Environmental Condition
ReNEW	"Revitalizing Environmentally Neglected Emerging Workplaces"
RISC	Risk Integrated System of Closure
RPD	Relative Percent Difference
RWP	Remediation Work Plan
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
VRP	Voluntary Remediation Program

OVERVIEW

The City of Michigan City (City) has identified a Brownfield project team to assess the redevelopment potential the former Karwick Road Landfill Site. This team includes the Michigan City Economic Development Corporation (MCEDC), Environmental Incorporated (EI), and APT, Limited (APT). The MCEDC is a not-for-profit 501(3)c and will act as the project team leader coordinating planning and institutional aspects of the proposed assignment. Assisting the MCEDC with this assignment is EI. The environmental consulting and assessment activities will be performed by APT of Granger, Indiana. APT will also provide regulatory management for the project associated with the Indiana Voluntary Remediation Program (VRP).

The former Karwick Road Landfill Site is located on Karwick Road near the intersection of Warnke Road and Karwick Road, in Michigan City, Indiana (see **Figure 1**). The lat/long coordinates associated with the facility are 86° 51' 30"W 41° 42' 25"N; the UTM coordinates are 16 511945E 4617730N. The township/range coordinates for the facility are SE1/4 of SE1/4 SE ½ of Section 27, T38N, R4W.

The site was historically used as a landfill and detailed information of disposed material and locations is absent. The landfill area was covered with a several foot layer of fill material, mainly sand, and has been abandoned for an estimated 30+ years. The site is no longer being used for waste disposal purposes.

The Site consists of approximately 5.5 acres out of an approximately 23.5 acre property, and is that portion of the property that was formerly used as a landfill. The Site contains no buildings or structures, and is largely overgrown with weeds and small trees. Some portions of the Site contain large pieces of concrete rubble. Trail Creek, which separates an undisturbed 18-acre floodplain from the former 5.5-acre landfill, defines the western boundary of the Site. Cheney Run is west of Trail Creek and becomes confluent with Trail Creek approximately midway along the western boundary of the Site. The areas immediately adjacent to and west of Trail Creek are heavily wooded. Dirt trails run throughout the Site. A site map is included as **Figure 2**.

The Site is located in a predominantly rural/residential area in Michigan City, LaPorte County, Indiana. The areas located immediately east of the Site are undeveloped and heavily wooded. The Chicago South Shore & South Bend Railroad and Chesapeake & Ohio Railroad (CSX) lines border the Site to the north and south. A third rail line, the Norfolk and Western Railroad, borders the southwest side of the 18-acre portion of the 23.5-acre property that is not the subject of this VRP project. An electrical substation is located northeast of the property, along the Chicago-South Shore rail line. The southeastern portion of the Site is bordered by a Northern Indiana Public Service Company right-of-way. A high-pressure gas line runs through the right-of-way to a transfer station located along the eastern side of Karwick Road. Residential properties are located south of the Site beyond the CSX rail line. The properties north of the Chicago-South Shore rail line and west of the Site are undeveloped wooded areas.

Electric power, natural gas, city water, and sanitary sewer services do not currently service the Site. However, city utilities do service the surrounding areas. According to city officials, no buildings have ever been present at the property and no utilities have ever been extended onto the Site.

The site assessment activities at the subject property have been funded by a USEPA Brownfields Pilot Grant. The site has been entered into the Indiana VRP, and will follow the July 1996 VRP Guidance.

The objective of the assessment was to define the site issues such that appropriate risk management and redevelopment decisions regarding future use of the site can be made in the context of the 1997 Indiana Brownfield Legislation (SEA 360 - CC. No. 02). The site assessment at the former Karwick Road Landfill site collected data to identify environmental liabilities (if any) associated with the site, and to define applicable regulatory strategies to address the site issues in the context of the Indiana Brownfield Development Program.

APT's role is to conduct Phase II Investigations, Due-Care planning, and Remediation and Closure activities. This document presents the Quality Assurance Project Plan (QAPP) for investigations that will be performed at the site. This QAPP has been developed in general accordance with the guidance presented in *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5), *Quality Assurance Guidance for Conducting Brownfields Site Assessments* (EPA 540-R-98-038), and consistent with the requirements published in the *VRP Guidance Manual* (IDEM, July 1996).

1.0 PROJECT MANAGEMENT

The purpose of this document is to describe the personnel, procedures, and methods for assuring the quality, accuracy, and precision of data associated with the City's Project ReNEW ("Revitalizing Environmentally Neglected Emerging Workplaces"). Project ReNEW will include a brownfield assessment of the former Karwick Road Landfill Facility. Adhering to the procedures detailed in this QAPP will ensure that the project data meet the standards set by federal and state regulators. Lastly, by implementing the QAPP, the project team should make the most efficient use of project funds.

1.1 PROJECT ORGANIZATION AND RESPONSIBILITY

The City has identified a Brownfield project team to assess the redevelopment potential of the site under Project ReNEW. This team includes personnel from the MCEDC, EI, and APT. The MCEDC is a not-for-profit 501(3)c and will act as the Project ReNEW team leader coordinating planning and institutional aspects of the proposed assignment. Assisting the MCEDC with this assignment is EI. The environmental consulting and assessment activities will be performed by APT of Granger, Indiana. APT will also provide regulatory management for the project associated with the Indiana VRP.

APT's role will be to conduct Phase II Investigations, Due-Care planning, Remediation and Closure activities. This document presents the QAPP for investigations that will be performed at the site. This QAPP has been developed in general accordance with the guidance presented in *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5) and *Quality Assurance Guidance for Conducting Brownfields Site Assessments* (EPA 540-R-98-038).

All lines of communication, management activities, and technical direction within the City project team will follow organization and arrangement protocol. Any directions from the United States Environmental Protection Agency – Region 5 (USEPA) to the City will flow from the identified USEPA Project Manager to the Project ReNEW Director, who will subsequently communicate directions to the Project Coordinator (EI) and the APT Project Manager. Any communication from the IDEM VRP should be directed to the Project ReNEW Director, who will subsequently communicate directions to the APT Project Manager.

The specific responsibilities for this project are described below:

<u>**USEPA Project Manager**</u>

1. Direct review of the QAPP, Health & Safety Plan (HASP), and the Sampling and Analysis Plan (SAP).
2. Provide technical consultation services to Michigan City, Pilot Project Manager, and QA Field Officer.
3. Review progress reports detailing work accomplished.
4. Review all final reports.

USEPA Quality Assurance Reviewer

1. Review the QAPP.
2. Assist in review of SAPs.

IDEM VRP Project Manager

1. Provide technical consultation services to Michigan City, Pilot Project Manager, and QA Field Officer.
2. Review all reports submitted to the IDEM VRP.
3. Coordinate closure sampling with APT Project Manager.
4. Provide administrative support throughout the VRP process.

Project ReNEW Director

1. Direct all project activities.
2. Provide direct supervision and project assignments to Project Coordinator.
3. Direct the preparation and submission of progress reports detailing work accomplished, funds expended, and status of schedule and work plan for the Brownfield Pilot Grant.
4. Review all reports for consistency with objectives stated in work plans.
5. Final signature on all assessment activities.

Project Coordinator (EI)

1. Prepare and submit progress reports detailing work accomplished, funds expended, and status of schedule and work plan for the Brownfield Pilot Grant to the Project ReNEW Director.
2. Responsible for the review of all project deliverables, development of pilot planning, and the overview of all project strategies.

APT Quality Assurance Officer

1. Oversee assessment activities to ensure that sampling methodology, sample preservation methods, and chain-of-custody (COC) procedures are being adequately adhered to (*e.g.*, assure that blank and duplicate samples are provided with each set of samples).
2. Meet with the assessment team members to discuss and review analytical results prior to completion of reports.
3. Assist in any QA issues with field or laboratory questions, as needed.
4. Coordinates data validation requests through USEPA.
5. As required, prepare requests for special analytical needs from USEPA Region V.

APT Project Manager

1. Responsible for development of the site-specific HASP, SAP, and QAPP, in accordance with USEPA and IDEM requirements.

2. Prior to initiating field activities at each site, meet with Project ReNEW Director, Project Coordinator, QA Officer, and Field Geologist to discuss and establish sampling purposes, sampling methodology, number of samples, size of samples, sample preservation methods, COC requirements, analyses required, and which samples will be duplicated in the field.
3. In charge of assessment team organization and delegation of specific tasks to be performed by field staff.
4. Coordinate with laboratory regarding sample analyses and deliverables.
5. Maintain a record of all samples taken and the sample identification information on each sample.
6. Meet with the assessment team members to discuss and review analytical results prior to completion of reports.
7. Coordinate preparation of the assessment report after all necessary assessment work has been completed.
8. Coordinate laboratory services.

APT Field Geologist

1. Prior to initiating field activities, meet with the APT Project Manager to discuss and establish sampling purposes, sampling methods, number of samples, size of samples, sample preservation methods, COC requirements, analyses required, and which samples will be duplicated in the field.
2. Responsible for collection of equipment needed for assessment work. The equipment would include personnel protective gear, sample equipment and containers, sample coolers, first aid equipment, etc.
3. Oversee drilling activities to ensure that proper procedures are followed during installation of monitoring wells and collection of soil samples from soil borings.
4. Monitor for hazardous conditions while conducting assessment activities in the field.
5. Document all field activities, visitors to site, site conditions, and geologic observations in field notebook and boring log sheets.
6. On at least a daily basis, and more often as warranted, discuss field activities with the APT Project Manager.
7. Coordinate sample bottle delivery and sample shipping with laboratory.
8. Submit copies of all COC records and field paperwork to APT Project Manager.

Laboratory

1. Responsible for analyses of soil and groundwater samples to yield valid data. Samples will be managed, prepared, and analyzed in accordance with SW-846 methods.
2. Provide sample receipt forms in a timely manner to APT Project Manager.

3. Notify APT Project Manager of sample irregularities, including broken sample containers, exceeded hold times, broken custody seals, and errors/inconsistencies in chain-of-custody forms.

Ms. Diane Spencer will serve as the USEPA Project Manager, Ms. Jan Pels will serve as the USEPA Quality Assurance Reviewer, Mr. Bill Weiringa has been identified as the IDEM VRP Project Manager, Mr. Tony Rodriguez of the MCEDC will serve as the Project ReNEW Director, Mr. Tom Stevenson (EI) will serve as the Project Coordinator, and Mr. John Klanke will serve as the APT Project Manager. The Project Consultant Quality Assurance and Data Management officer will be Ms. Andrea DePoy of APT. Qualified APT personnel will conduct site assessment activities. Supporting staff from APT, and private contractors (if needed), will be assigned on an as needed basis.

All APT site personnel shall have completed specialized training as mandated by the Occupational Safety and Health Administration (OSHA) Act regulations (29 CFR 1910.120). All site personnel shall be properly trained in the procedures for collection, labeling, packaging, and shipping of soil and groundwater samples.

Any subcontractors used by APT for the purpose of obtaining environmental media samples, shall have completed specialized OSHA training, in accordance with applicable regulations. Additionally, subcontractors will be required to comply with all site safety requirements addressed in the site-specific HASP.

1.2 FACILITY HISTORY/BACKGROUND INFORMATION

Refer to the site-specific SAP for detailed facility history and background information.

1.3 PROJECT DESCRIPTION AND SCHEDULE

The City of Michigan City has implemented Project ReNEW to assess the redevelopment potential of the former Karwick Road Landfill Site.

The former Karwick Road Landfill Site is located on Karwick Road near the intersection of Warnke Road and Karwick Road, in Michigan City, Indiana. The lat/long coordinates associated with the facility are 86° 51' 30"W 41° 42' 25"N; the UTM coordinates are 16 511945E 4617730N. The township/range coordinates for the facility are SE1/4 of SE1/4 SE ½ of Section 27, T38N, R4W. **Figure 1** is a portion of two United States Geological Survey 7.5 minute topographic maps (Michigan City East, Indiana Quadrangle 1980) showing the site location.

The site was historically used as a landfill and detailed information of disposed material and locations is absent. The landfill area was covered with a several foot layer of fill material, mainly sand, and has been abandoned for an estimated 30+ years. The site is no longer being used for waste disposal purposes.

The Site consists of approximately 5.5 acres out of an approximately 23.5 acre property, and is that portion of the property that was formerly used as a landfill. The Site contains no buildings or

structures, and is largely overgrown with weeds and small trees. Some portions of the Site contain large pieces of concrete rubble. Trail Creek, which separates an undisturbed 18-acre floodplain from the former 5.5-acre landfill, defines the western boundary of the Site. Cheney Run is west of Trail Creek and becomes confluent with Trail Creek approximately midway along the western boundary of the Site. The areas immediately adjacent to and west of Trail Creek are heavily wooded. Dirt trails run throughout the Site. A site map depicting a plan view of the entire 23.5-acre property and the 5.5-acre Site is shown on **Figure 2**.

The Site is located in a predominantly rural/residential area in Michigan City, LaPorte County, Indiana. The areas located immediately east of the Site are undeveloped and heavily wooded. The Chicago South Shore & South Bend Railroad and Chesapeake & Ohio Railroad (CSX) lines border the Site to the north and south. A third rail line, the Norfolk and Western Railroad, borders the southwest side of the 18-acre portion of the 23.5-acre property that is not the subject of this VRP project. An electrical substation is located northeast of the property, along the Chicago-South Shore rail line. The southeastern portion of the Site is bordered by a Northern Indiana Public Service Company right-of-way. A high-pressure gas line runs through the right-of-way to a transfer station located along the eastern side of Karwick Road. Residential properties are located south of the Site beyond the CSX rail line. The properties north of the Chicago-South Shore rail line and west of the Site are undeveloped wooded areas.

Electric power, natural gas, city water, and sanitary sewer services do not currently service the Site. However, city utilities do service the surrounding areas. According to city officials, no buildings have ever been present at the property and no utilities have ever been extended onto the Site.

The assessment at the subject property has been funded by a USEPA Brownfields Pilot Grant. The site has been entered into the Indiana VRP, and will follow the July 1996 VRP Guidance.

The objective of the assessment was to define the site issues such that appropriate risk management and redevelopment decisions regarding future use of the sites can be made in the context of the 1997 Indiana Brownfield Legislation (SEA 360 - CC. No. 02). The site assessment activities at the former Karwick Road Landfill Site provide data to facilitate the reuse of the subject property through identifying environmental liabilities (if any) associated with the site, and to define applicable regulatory strategies to address the site issues in the context of the Indiana Brownfield Development Program.

The site investigation described in the site-specific SAP represents the second phase (Phase II Environmental Site Assessment (ESA)) of the Brownfield site assessment process. The initial phase involved conducting a Phase I ESA at the site. The Phase I ESA was conducted in general accordance with the American Society of Testing Materials (ASTM) *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (E1527-00)*. Data collected from the subject site will be used to assess the presence and characteristics of contamination, including the threat it poses, potential solutions for cleanup and estimated costs for site redevelopment. Site investigation activities may consist of one or all of the following tasks:

- Collection and analysis of soil samples
- Collection and analysis of groundwater samples
- Installation of temporary and/or permanent groundwater monitoring wells
- Evaluation of aquifer characteristics
- Evaluation of cleanup options and costs
- Assessment of the usability of resulting data

Details on the selected sampling activities are discussed in the site-specific SAP.

1.4 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are comprehensive statements that specify the quality and quantity of the data required to support decisions made during the investigation activities. The DQOs and are based on the ultimate use of the data to be collected. As such, different data uses may require different levels of quality. Please refer to the site-specific SAP for a detailed discussion of the data collection and analyses performed as part of the subsurface investigation.

1.4.1 Project Quality Objectives

The USEPA and the IDEM require that the project quality objectives be defined, including a problem statement, decision identification, decision inputs, investigation boundaries, and the project decision process.

1.4.1.1 Problem Statement

Project ReNEW is considering redevelopment options for the subject property. A Phase I ESA has been performed and has identified recognized environmental conditions (RECs) that may have caused actual or perceived threats to redevelopment. The Phase II ESA has also been performed, per the SAP approved by the USEPA, which describes in detail the methods used to identify constituents of concern, and assess the hazards posed by these constituents of concern. Exposure assessments and proposed redevelopment use of the subject property are discussed in the *VRP Remediation Work Plan* (RWP) in accordance with the Indiana VRP.

1.4.1.2 Decision Identification

All available information will be utilized to determine if the subject property has been at least partially contaminated. To assess the feasibility of redevelopment of the subject property, Project ReNEW will make the following decisions:

- Have the issues of concern been addressed?
- Do constituent concentrations exceed published VRP cleanup objectives for the intended land use?
- Can the constituents of concern present at the site be managed by eliminating exposure pathways?
- Will the property require remediation before it can be reused?
- What level of cleanup or other action is necessary to answer the questions of developers and lender?
- Is cleanup too expensive, or can the property be developed for another use?

1.4.1.3 Decision Inputs

In order to assess the level of soil, groundwater, surface water and/or sediment contamination present at the property, soil, groundwater, surface water, and sediment samples have been/will be collected for analysis, as described in the SAP. These samples will be collected for the purpose of either: 1) assessing the data gaps identified in any work previously completed at the subject property, or 2) assessing the RECs identified during the Phase I ESA. Such data gaps and/or potential areas of concern may include the following:

- Did past hazardous substance handling/housekeeping activities/disposal activities impact the property?
- Have past uses of the subject property or adjacent properties impacted the soil and/or groundwater?
- Have former/existing above-ground storage tanks (ASTs) and/or underground storage tanks (USTs) impacted soils and/or groundwater at the subject property?
- Has there been uncontrolled dumping/landfill activities at the subject property, and are there impacted soils and/or groundwater as a result?
- Does fill material utilized at the subject property contain contaminants, which may or may not have impacted soil and/or groundwater?
- What is the degree of potential exposure to surface/subsurface soils at the property?
- What is the degree of potential exposure to groundwater at the property?
- Are there critical habitats present that could be potentially affected by past/current site conditions?
- What are the potential impacts to critical habitats?

1.4.1.4 Investigation Boundary

A site plan showing the investigation boundary relative to the property boundary and structures is provided in the SAP and the *VRP RWP*. The investigation boundary presented in the SAP will also identify individual RECs (*i.e.*, potential exposure areas), proposed sample locations and depths, practical constraints (geography, meteorological conditions, site accessibility, time, and availability of personnel or equipment).

1.4.1.5 City of Michigan City Decision Process

The VRP Tier II cleanup objectives for a Non-Residential land use scenario will be the applicable standard for evaluating remedial options and the redevelopment potential of the subject property. The constituents of concern and their proposed cleanup criteria are listed in Table 1 of the *VRP RWP*. If concentrations of target constituents in soil and/or groundwater samples results collected as part of the completion sampling are all below applicable VRP Tier II default cleanup criteria, as presented in the VRP Guidance Manual, then "No Further Action" is appropriate for the site, a *VRP Completion Report* will be prepared and submitted to the IDEM, and the redevelopment project can proceed as planned (assuming the completion sampling verifies the results of the site investigation). Soil metal concentrations may also be subjected to comparison with other guidance values, such as published or measured background concentrations typical for the region.

However, if completion sample results exceed the Tier II criteria, the following options will be considered by the City for the property:

1. If the arithmetic mean of all soil samples is below the cleanup objective on a constituent-by-constituent basis and no sample exhibits a constituent concentration greater than 10 times the cleanup objective, then redevelopment process can proceed as planned.
2. If constituent concentrations exceeding cleanup criteria are limited to less than 10% of the total number of soil, groundwater, surface water, and/or sediment samples analyzed, the City will resample the specific locations indicating elevated contaminant levels. If one or all of the results support the original data, the City will proceed to Step #3 below. If all resample results indicate no exceedance of Cleanup criteria, no further actions will be performed at the subject property.
3. Can a facility-specific remedial plan be developed for the proposed future use of the property with the available data? If not, additional assessment activities may be performed to completely define the nature and extent of impacts.
4. If constituent concentrations are found to exceed only the soil and groundwater remediation objectives associated with a specific exposure pathway, is cleanup to the default cleanup criteria necessary for redevelopment for the proposed future use, or can an exclusion of that exposure pathway through the use of engineered barriers or institutional controls be pursued?

5. If an exposure pathway cannot be eliminated or if remediation is not cost effective, then the City may develop a facility-specific action plan to meet the needs of the proposed future use of the property, or elect not to take title to a particular property and withdraw that site from the VRP.

1.4.2 Analytical Quality Objectives

This project will utilize Confirmational (DQO Level 4) levels of analytical data quality as defined in the VRP Resource Guide (IDEM, July 1996) for all completion sampling. If additional site assessment activities are performed, the project will utilize Screening (DQO Level 2) and Engineering (DQO Level 3) levels of analytical quality as defined in the VRP Resource Guide (IDEM, July 1996).

1.4.2.1 Field Screening Data Analyses

Field screening instruments provide the lowest data quality compared to laboratory instruments in a controlled environment, but the most rapid results. These techniques are often used for health and safety monitoring at the property, preliminary comparison to Default Cleanup Levels, initial site characterization to locate areas for subsequent and more accurate analysis, and for engineering screening of alternatives. This type of data includes those generated by on-site geophysical surveys and photoionization detector (PID), pH, conductivity, temperature or other real time monitoring equipment. The IDEM also considers groundwater samples collected from open boreholes or via Geoprobe as screening level data.

There will be field screening data collected during the proposed soil and groundwater sampling. The breathing space of site personnel will be monitored using a PID for the presence of organic vapors. The PID will also be used to perform field screening of soil cores to assist in the selection of samples for laboratory analysis. The soil core interval having the highest PID readings at each boring or sampling location will typically be selected for laboratory analyses. If no volatile constituent contamination is identified as a result of the field screening, a sample from each boring or sampling location will be selected based on obvious discoloration or other visible signs of contamination. If there is no visible sign of impact, the sample will be collected from the vadose zone at a depth just above capillary fringe associated with the water table.

Additionally, pH, conductivity, and temperature measurements will be collected during groundwater sampling activities. Lastly, if additional assessment activities are necessary, groundwater samples may be collected from soil borings. These samples (if collected) will be shipped to a fixed laboratory following standard chain-of-custody procedures and analyzed for constituents of concern using SW-846 Methods. While these groundwater samples will be analyzed using SW-846 Methods, which will allow for detection limits consistent with VRP requirements associated with Engineering Level DQOs, the analytical data will be considered screening data (per IDEM policy) since they were not collected from properly constructed monitoring wells. As such, these data will suffice to provide a basis for the placement of permanent monitoring wells as well as fill data gaps between monitoring wells.

When evaluating the groundwater screening data, the project team will compare the detected contaminant concentrations and the analytical detection limits to VRP Tier II Cleanup Objectives for an Industrial land use scenario.

1.4.2.2 Engineering Level Data Analyses

If additional assessment is necessary, soil and groundwater samples collected at the site will be collected consistent with VRP guidance for conducting site investigations. Soil samples will be collected using either a Geoprobe equipped with a properly decontaminated sampling tube and liner, or a mobile drilling rig equipped with a split-spoon sampling device that will be advanced ahead of a hollow stem auger chain. Groundwater samples used for the purpose of site characterization and evaluation of remedial alternatives will be collected from monitoring wells installed and constructed in accordance with IDEM guidance. The soil and groundwater sampling program (if necessary) will include a defined decontamination procedure for all sampling equipment, and strict sample handling and custody procedures.

Soil and groundwater samples will be shipped to a fixed laboratory following standard chain-of-custody procedures and analyzed for constituents of concern using SW-846 Methods. The use of SW-846 Methods will allow for detection limits consistent with VRP requirements associated with Engineering Level (Level 3) DQOs.

1.4.2.3 Confirmation Level Data Analyses

It is the City of Michigan City's objective to obtain a *Certificate of Completion* and *Covenant Not to Sue* via the VRP. The VRP follows a regulatory program defined in Indiana Code 13-25-5. Soil samples will be collected using a Geoprobe equipped with a properly decontaminated sampling tube and liner, or using a mobile drilling rig equipped with a split-spoon sampling device that will be advanced ahead of a hollow stem auger chain. Groundwater samples to used for the purpose of closure must be collected from monitoring wells installed and constructed in accordance with IDEM guidance.

The VRP requires that analytical procedures follow SW-846 or CLP SOW protocol and meet published VRP cleanup objectives. Additionally, the VRP requires that completion sampling be performed consistent with Confirmation Level (Level 4) DQOs. Therefore, soil, groundwater, surface water, and sediment completion samples obtained for the purpose of demonstrating compliance with VRP cleanup objectives will be analyzed by a fixed laboratory using SW-846 Methods. The laboratory audit and Quality Assurance/Quality Control (QA/QC) procedures are documented later in this QAPP.

1.4.3 Measurement Performance Criteria

All APT site personnel shall have completed specialized training as mandated by the OSHA regulations (29 CFR §1910.120). Furthermore, all site personnel shall be property trained in the procedures for collection, labeling, packaging, and shipping of solid and liquid waste samples. Personnel training records will be maintained by APT.

Contractors used by APT and the City for the purpose of securing soil and/or liquid waste samples shall have completed specialized OSHA training in accordance with 29CFR §1910.120. Additionally, contractors to APT will be required to comply with all site safety requirements addresses in the HASP.

1.5 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

The overall quality assurance (QA) objective for the project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide legally defensible results. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventative maintenance of field equipment, and corrective action are described in other sections of this QAPP.

DQOs for measurements during this project will be addressed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC parameters). The numerical PARCC parameters will be determined from the project DQOs to insure that they are met. The DQOs and resulting PARCC parameters will require that the sampling be performed using standard methods, with properly operated and calibrated equipment, and conducted by trained personnel.

1.5.1 Precision

Precision is the determination of the reproducibility of measurement under a given set of conditions of a quantitative measure of the variability of a group of measurements compared to their average value. Precision is either reported, depending upon the end use of the data, as relative percent difference (RPD) or standard deviation. The RPD will be calculated using the following formula:

$$RPD = \frac{\text{absolute}(X_1-X_2)}{\frac{(X_1+X_2)}{2}} \times 100\%$$

Where: X_1 = first observed value
X_2 = second observed value

1.5.1.1 Field Precision Objectives

A summary of the precision objectives for field instruments is presented in **Table 1**. Field precision will be assessed through the collection and analysis of duplicate samples. Water matrix samples can be readily duplicated due to their homogeneous nature; however, the duplication of soil or sediment (solid) samples is much more difficult due to the non-homogeneous nature of soils/sediments. As a result, soil duplicate recovery should be ± 35 percent of the investigative sample. One duplicate sample will be collected per 10 investigative samples at each site for both soil and water matrices. At least one duplicate soil and water sample will be collected for each sampling round performed at each site.

1.5.1.2 Laboratory Precision Objectives

The precision of laboratory analyses will be based upon laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses. MS/MSD analyses will be either at a rate of 1 per 20 samples received by the laboratory or in accordance with laboratory Standard Operating Procedures (SOPs). Precision is reported as RPD. The detection limit for each analyte must be equal to or lower than the benchmark criteria that will be used for this project, the VRP closure criteria.

These criteria are defined in the Risk Integrated System of Closure (RISC) Technical Guidance Document (IDEM, February 2002).

1.5.2 Accuracy

The definition of accuracy is the degree of agreement between a measurement or observed value and an accepted reference or true value. The field and laboratory accuracy objectives are identified below.

1.5.2.1 Field Accuracy Objective

A summary of the accuracy objectives for field instruments is presented in **Table 1**. Sampling accuracy will be assessed by evaluating the results of field and trip blank samples for contamination. A trip blank will consist of a laboratory-prepared sample of reagent grade water. Trip blanks will accompany sample containers and be subjected to the same procedures as the investigative samples. Trip blanks are only required when VOCs are constituents of concern. Trip blanks will be submitted for analysis at the rate of one trip blank per shipping container containing investigative water samples for VOC analysis using Method 8260.

Field blanks (equipment blanks) will be collected by pouring laboratory-prepared water or distilled water over or through the sampling equipment and collecting the rinseate in the proper analytical containers. Field blanks are required at the rate of one per 10 investigative samples with a minimum of one per sampling event. A groundwater sampling event is a routine sampling of all monitoring wells within the monitoring system.

1.5.2.2 Laboratory Accuracy Objectives

The analysis of MS/MSD samples can be utilized to determine laboratory accuracy. In addition, the analysis of referenced standard samples, laboratory control samples, surrogate compounds, and percent recoveries are also utilized for laboratory accuracy determinations. Accuracy goals for parameters to be analyzed will be in accordance with the provisions of the USEPA methods. Accuracy will be evaluated by comparing recovery of surrogate compounds or spiked analytes against the known values using the following formula:

$$\% \text{ Recovery} = \frac{(\text{Total Analyte Found} - \text{Analyte Originally Present}) \times 100\ \%}{\text{Analyte Added}}$$

Laboratory accuracy objectives are defined in the laboratory SOPs for volatiles, semivolatiles/PCBs, and metals analyses.

1.5.3 Representativeness

The degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition, defines representativeness. Field and laboratory representativeness are described below.

1.5.3.1 Measures to Ensure Representativeness of Field Data

Representativeness will be achieved by establishing the level of allowable uncertainty in the data and then statistically determining the number of samples needed to characterize the population through the DQO process. It will also be achieved by insuring that sampling locations are properly selected. Representativeness is dependent upon the proper design of the sampling program and will be accomplished by ensuring that this QAPP, the SAP, and all relevant SOPs are followed. The QA goal will be to have all samples and measurements representative of the media sampled. Field testing for pH, temperature, and conductivity stabilization prior to groundwater sampling will help ensure that representative samples are collected.

1.5.3.2 Measures to Ensure Representativeness of Laboratory Data

Representativeness of laboratory data cannot be quantified; however, adherence to the prescribed analytical methods and procedures, including holding times, blanks, and duplicates, will ensure that the laboratory data is representative.

1.5.4 Completeness

The measure of the quantity of valid data obtained from a measurement system compared to the quantity that was expected, under normal conditions, is the definition of completeness. Although a completeness goal of 100% is desirable, an overall completeness goal of 90% may be realistically achieved under normal field sampling and laboratory analysis conditions. Field and laboratory completeness are described below.

1.5.4.1 Field Completeness Objectives

The field sampling crew will take measures to have data generated in the field be valid (complete); however, some samples may be lost or broken in transit. The field completeness goal for this project is to have 90% of collected samples constitute valid data.

1.5.4.2 Laboratory Completeness Objectives

Laboratory completeness will be a measure of the quantity of valid data measurements and analyses obtained from all the measurements and analyses completed for the project. The laboratory completeness objective for this project is to have 90% of analyzed samples constitute valid data.

1.5.5 Comparability

The confidence with which one data set can be compared to another is a measure of comparability. The ability to compare data sets is particularly critical when a set of data for a specific parameter is compared to historical data for determining trends. Field and laboratory comparability are described below.

1.5.5.1 Measures to Ensure Comparability of Field Data

The comparability of field data will be satisfied by ensuring that the SAP and QAPP are adhered to and that all samples are properly handled and analyzed. Also an effort will be made to have sampling done in a consistent manner by the same samplers (when possible).

1.5.5.2 Measures to Ensure Comparability of Laboratory Data

Analytical data are comparable when the data are collected and preserved in the same manner, followed by analysis with the same standard method and reporting limits. Data comparability is limited to data from the same environmental media. Analytical method quality specifications have been established to help ensure the data will produce results that are comparable.

1.6 DOCUMENTATION AND RECORDS

Records that will be generated as part of the subsurface investigation are critical to the completion of a quality product. APT will utilize select APT documents for recording information during project activities. Records that shall be a part of the project documentation for the investigation include field forms, field log books, chain-of-custody records, laboratory data sheets, and technical reports. The records shall be maintained in APT's office files for a period of two years, following the termination of activities or receipt of the *Certificate of Completion* from the IDEM. These files will be transferred to APT's permanent storage (archive files) beyond that two year period. Draft versions of reports will be maintained until the final version of the report is created, at which point they will be destroyed.

The draft and final *VRP RWP* and *VRP Completion Report* submittal packages will include at least the following:

- Text describing field sampling methodologies, analytical findings, conclusions and recommendations.
- Text discussing QA/QC sample results, including precision, accuracy, and completeness.
- Figures depicting property location, property structures, sampling locations, and horizontal and vertical extents of contamination.
- Tables comparing all laboratory data results to applicable IDEM VRP Tier II Default cleanup criteria and summarizing all field QA/QC analytical results.
- Complete laboratory data reports, including copies of all chain-of-custody records.
- Computer-generated soil boring and/or groundwater monitoring well logs.
- Other relevant material required for support of the property development scenario.

2.0 MEASUREMENT DATA ACQUISITION

The purpose of the QAPP is to produce reliable data, which will be generated throughout the investigation by:

- Ensuring data validity and integrity;
- Assuring and providing mechanisms for ongoing control of data quality;
- Evaluating data quality in terms of PARCC, and;
- Providing usable, quantitative data for analysis, interpretation and decision making.

2.1 SAMPLE PROCESS DESIGN

Sample locations, analytical parameters, and frequency of sample collection are discussed in the VRP RWP and/or SAP. Laboratory test parameters for the surface and subsurface investigation sampling program will include soil, groundwater, surface water, and sediment analysis for one or more of the following parameters:

- Priority Pollutant List (PPL) Volatile Organic Compounds (VOCs)
- PPL Base/Neutral Acids (BNAs)
- PPL Polychlorinated Biphenyls (PCBs)
- PPL Metals

Analytical parameters will be chosen based on representative contaminants that were most commonly associated with the former activities at the subject property.

QA/QC samples will be submitted in accordance with the QAPP protocols presented in the following sections. Requirements for field QA/QC samples are identified on **Table 2**.

2.2 ANALYTICAL METHODS REQUIREMENTS

Soil samples, sediment samples, surface water samples, groundwater samples collected from permanent monitoring wells, and any groundwater screening samples collected from Geoprobe borings will be submitted to a private laboratory for analyses using SW-846 Methods. Per VRP requirements, some of the closure-level completion samples will be split with the IDEM.

The components of data acquisition for the surface and subsurface investigation are discussed in detail in this QAPP and in the VRP RWP. Sample collection, preparation and decontamination procedures are also detailed in both this QAPP and in the SAP. Sample preservation, holding time, and volume requirements are summarized on **Table 3**. Soil, groundwater, surface water, and sediment samples will be analyzed for suspected contaminant parameters typically common to past activities associated with the subject property.

All soil, groundwater, surface water, and/or sediment samples will be collected in accordance with applicable SOPs, and analyzed in accordance with SW-846 Methods. Bottles/containers utilized for the collection of samples will be provided by the laboratory and will be pre-cleaned to current USEPA and IDEM standards. Bottles will be provided with preservatives (as appropriate). The bottle vendor will also be responsible for supplying trip blanks.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The City and APT will follow standard custody procedures as defined herein. The data requiring custody procedures includes field samples and data files that can include field books, logs, and laboratory reports. An item is considered in "custody" if it is:

- In a person's possession;
- In view of the person after being in their possession;
- Sealed in a manner that it can not be tampered with after having been in a physical possession; or
- In a designated secure area.

Various aspects of sample handling and shipment, as well as the proposed sample identification system and documentation are discussed in the following subsections.

2.3.1 Sample Identification System

All sample containers will be labeled. Each sample label shall at a minimum indicate:

- The sample type;
- Date/time of sample collection;
- Sampler's initials;
- Required analyses;
- Type of preservation; and
- Sample location identifier.

All labels will be filled out with waterproof ink. Samples will be assigned a unique sample ID code, as follows:

- Sample nomenclature for soil samples will consist of the soil boring identification number followed a semicolon and the depth below the ground surface (BGS) at which the soil sample is collected. For example, a soil sample collected from a depth of 25 feet BGS in soil boring SB-1 would be identified as *SB-1; 25'*.
- Sample nomenclature for groundwater screening samples will consist of the soil boring identification number followed by a semicolon and the six-digit representation of the date on which the groundwater sample is collected. For example, a groundwater sample collected from a Geoprobe boring named GB-12 on July 15, 2004 would be identified as *GB-12; 071504*.

- Sample nomenclature for groundwater samples will consist of the monitoring well identification number followed by a semicolon and the six-digit representation of the date on which the groundwater sample is collected. For example, a groundwater sample collected from monitoring well MW-1 on August 15, 2004 would be identified as *MW-1; 081504*.

- Sample nomenclature for surface water samples will consist of the surface water sample location number followed by a semicolon and the six-digit representation of the date on which the surface water sample is collected. For example, a surface water sample collected from the sample location point #1 on March 17, 2004 would be identified as *SW-1;031704*.

- Sample nomenclature for sediment samples will consist of the sediment sample location number followed by a semicolon and the six-digit representation of the date on which the surface water sample is collected. For example, a sediment sample collected from the sample location point #1 on June 5, 2004 would be identified as *SD-1;060504*.

- Duplicate soil samples will be identified by the prefix "DUP" followed by a dash, a unique number ID, a semicolon, and the six-digit representation of the date on which the sample was collected. For example, a duplicate soil sample collected from soil boring SB-1 on July 15, 2004 might be identified as *DUP-#1; 071504*.

- Duplicate groundwater samples will be identified by the prefix "DUPGW" followed by a dash, a unique number ID, a semicolon, and the six-digit representation of the date. For example, a duplicate groundwater sample collected from monitoring well MW-1 on August 15, 2004 might be identified as *DUPGW-1; 081504*.

- Duplicate surface water samples will be identified by the prefix "DUPSW" followed by a dash, a unique number ID, a semicolon, and the six-digit representation of the date. For example, a duplicate groundwater sample collected from surface water sampling location #4 on March 17, 2004 might be identified as *DUPSW-1; 031704*.

- Duplicate sediment samples will be identified by the prefix "DUPSD" followed by a dash, a unique number ID, a semicolon, and the six-digit representation of the date. For example, a duplicate groundwater sample collected from sediment sampling location #2 on June 5, 2004 might be identified as *DUPSD-1; 060504*.

- Trip blanks will be identified by the prefix "TB" followed by the six-digit representation of the date. For example, a trip blank collected on March 17, 2004 would be identified as *TB; 031704*.

- Equipment rinsate blanks will be identified by the prefix "ER" followed by the six-digit representation of the date. For example, an equipment rinsate blank collected on March 17, 2004 would be identified as *ER; 031704*.

- Matrix spike and matrix spike duplicates for soil samples will be identified by the prefix "MS" and "MSD", respectively, followed by a dash, the soil boring name, a semicolon, and the depth BGS at which the sample was collected. For example, a matrix spike sample collected from a depth of 25 feet BGS in soil boring SB-1 would be identified as *MS/MSD-SB1; 25'*.

- Matrix spike and matrix spike duplicates for groundwater samples will be identified by the prefix "MS" and "MSD", respectively, followed by a semicolon and the six-digit representation of the date on which the sample was collected. For example, a matrix spike groundwater sample collected from monitoring well MW-8 on August 15, 2004 would be identified as *MS/MSD;081504*.
- Matrix spike and matrix spike duplicates for surface water samples will be identified by the prefix "MS" and "MSD", respectively, followed by the surface water sample location number, a semicolon, and the six-digit representation of the date on which the surface water sample is collected. For example, a surface water matrix spike sample collected from surface water sampling location #6 on March 15, 2004 would be identified as MS/MSD *SW-6;131504*.
- Matrix spike and matrix spike duplicates for sediment samples will be identified by the prefix "MS" and "MSD", respectively, followed by the sediment sample location number, a semicolon, and the six-digit representation of the date on which the sediment sample is collected. For example, a sediment matrix spike sample collected from sediment sampling location #1 on March 15, 2004 would be identified as MS/MSD *SD-1;031504*.

The corresponding sample identification number recorded on the sample label and the chain-of-custody form will also be recorded in the Field Logbook for reference purposes. The location of duplicate samples will be recorded in the Field Logbook.

All project related field data, records and documents will be maintained by APT on behalf of the City.

2.3.2 Sample Handling and Custody Procedures

The possession and handling of samples will be documented from the time of collection to the delivery to the laboratory. APT field personnel are responsible for ensuring that chain-of-custody documentation procedures are implemented. Field personnel will maintain custody of all samples until they are relinquished to another custodian, the laboratory, or a freight shipper. Field procedures are as follows:

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or shipped. As few people as possible should handle the samples.
- All bottles will be labeled with a stick-on label indicating the sample identifier, preservative used, date, time, analysis to be performed, and sampler name.
- The Project Manager must review all field activities to determine whether proper custody procedures were followed during the field work. The Project Manager should notify the USEPA and the City of a breach or irregularity in chain-of-custody procedures.
- The field geologist will maintain a field log book to document sample location, sample identification (using the nomenclature described in Section 2.3.1), time, and the type of sample(s) collected. The field geologist will also document the site conditions at the time of sampling.

A chain-of-custody form will be filled out and accompany the samples to the analytical laboratory. The form will also serve as a sample analysis request form, communicating to the laboratory the exact analysis (including method number) to be performed on each sample submitted. The chain-of-custody form will include the following information:

- Sample identification number;
- Signature of sample collector and other individuals in chain of possession;
- Date(s) of collection;
- Date(s) of relinquishment by individuals in chain of possession;
- Identification of analytical laboratory;
- Sample matrix;
- Sample container descriptions, number of sample containers per analysis, and types of analysis to be performed including analytical method numbers;
- Laboratory identification number (completed by laboratory);
- Integrity of cooler seals (to be noted by laboratory, if applicable); and
- Special instructions and remarks.

2.3.3 Sample Packaging and Shipping

Samples will be packaged and transported in a manner that maintains the integrity of the sample and permits the analysis to be performed within the prescribed holding time. Each sample container will be prepared in the field by attaching a completed sample label (refer to Section 2.3.1). The sample label and sample code will be sealed to the sample bottle using clear packaging tape to keep labels attached to the container if they become wet.

Each soil and/or groundwater sample will be placed in sealable bubble-wrap bags prior to placement into ice-cooled coolers. Ice will be placed in ziplock bags and placed in the bulk sample container (*i.e.*, cooler) along with the samples. Samples shipped to the laboratory will be documented on a chain-of-custody form(s), with the sampler's signature. The completed form will be enclosed in a ziplock bag and taped to the inside lid of the cooler that contains the samples listed on the form. Each cooler will be sealed prior to shipment utilizing a custody seal. Shipping cooler custody seals must be placed on two opposite corners of the cooler, and positioned to bisect the interface of the cooler body and lid. Custody seals will be covered with clear plastic tape. APT site personnel are responsible for contacting the appropriate laboratory when the samples are shipped. This may be accomplished by a telephone call, however it is recommended that the telephone conversation be documented and followed up with a confirmation facsimile.
If samples are shipped by common commercial carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the packaging will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

2.3.4 Documentation

Custody of samples shall be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. The documentation for each sample will include at a minimum the following information:

- Sample Tracking Log
- Chain of Custody Form
- Sample Identification Label
- Sample Shipment Log
- Shipping Documents (including airbill number)

2.3.5 Laboratory Chain-of-Custody Procedures

The applicable laboratory in accordance with their SOPs will perform laboratory custody procedures for sample receiving and log-in, sample storage, tracking during samples preparation and analysis, and storage of data.

2.3.6 Final Evidence Files Custody Procedures

APT will be responsible for the custody of the evidence files and maintain the contents of the files for the duration of the project. The evidence files include all relevant records, reports, logs. field notebooks, pictures, subcontractor reports and data reviews at the APT office. Data file retention periods are addressed Section 1.6 of this QAPP.

2.4 QUALITY CONTROL REQUIREMENTS

The quality control requirements have two components, field QC requirements and laboratory QC requirements.

2.4.1 Field QC Requirements

Where applicable, QC checks will be strictly followed during the investigation through the use of replicate measurements, equipment calibration checks, and data verification by APT field personnel. Field sampling precision and data quality will be evaluated through the use of sample duplicates, equipment blanks, and VOC trip blanks. Sample duplicates provide precision information regarding homogeneity, handling, transportation, storage, and analyses. Equipment (rinseate) blanks will be used to assure that property decontamination procedures have been performed and that no cross-contamination has occurred during sampling or transportation. VOC trip blanks will be used to assure that containers utilized to collect samples were free of contaminants, and that handling and shipping procedures did not induce contamination. If there is any discrepancy in the sample data, the Project ReNEW Director will be notified and resampling of the questionable point scheduled, if necessary. Requirements for field QA/QC samples are provided on **Table 2** of this QAPP. Actual site-specific QA/QC sample quantities are identified in the VRP RWP.

2.4.2 Laboratory QC Requirements

Analytical work for the subject property will be conducted by a private laboratory in accordance with current SW-846 Methods and IDEM guidelines. The laboratory QA manager will be responsible for assuring that the laboratory's data precision accuracy is maintained in accordance with specifications.

Internal laboratory QA/QC is performed on one of each twenty (1:20) samples analyzed. APT will identify which samples will be utilized for laboratory QA/QC. Water samples that are submitted for laboratory QA/QC will have an additional (replicate) set of samples collected from the sample location(s). No additional volume is required for MS/MSD analysis for soils.

2.5 INSTRUMENT CALIBRATION AND FREQUENCY

The calibration procedures to be employed for both the field and laboratory instruments used during the investigations at the site associated with Project ReNEW are referenced in this section. Measuring and test equipment used in the field and laboratory will be subjected to a formal calibration program. The program will require equipment of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and the desired results. Calibration of measuring and test equipment may be performed internally using in-house reference standards, or externally by agencies or manufacturers.

The responsibility for the calibration of laboratory equipment rests with the laboratory. APT field personnel are responsible for the calibration of APT field equipment and field equipment provided by subcontractors.

Measuring and testing equipment will be calibrated at prescribed intervals and/or as part of operational use. The frequency of calibration will be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Equipment will be calibrated using reference standards having known relationships to nationally recognized standards or accepted values of physical constants. If national standards do not exist, the basis for calibration will be documented.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent use and will be tagged to indicate the fault. Such equipment will be repaired and recalibrated to the satisfaction of the laboratory personnel or APT field personnel, as applicable. Equipment that cannot be repaired will be replaced.

Calibration procedures and results will be documented and maintained as part of the project files. Field equipment calibration will be documented in the field notebook. Laboratory equipment calibration records will be maintained by the laboratory.

The following subsections discuss the procedures for calibration and maintaining accuracy of all field analytical and screening instruments, and laboratory instrumentation.

2.5.1 Field Instruments and Equipment

Instruments used to gather, generate, or measure field environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field measurement instruments for the field investigations will include PID units that are used for detecting VOC vapors, and instruments for measuring pH, conductivity, and the temperature of liquids.

As applicable, all field instruments and equipment will be examined and calibrated daily, prior to being taken to the field, to check for operability and accuracy. This will include checking the manufacturer's operation manual and instructions to ensure that all maintenance requirements are being observed. Any malfunctions or repairs done to a piece of equipment will be noted in the field logbook for future reference. Calibration, acceptance criteria and associated corrective action response for field equipment will be in accordance with the manufacturer's specifications for the equipment. Equipment calibration information will be maintained in a field logbook that is dedicated to this project. Documentation will include the items listed below:

- Instrument being calibrated.
- Date and time of calibration.
- Identity of the person performing the calibration.
- Reference standard used, as applicable.
- Reading taken and adjustments made to attain the proper reading.
- Any corrective action or replacement of equipment.

Field calibration will be performed by trained personnel in accordance with the appropriate standard procedures or manufacturer's specifications. Calibration of field instruments will be performed at least twice daily, at the beginning and end of every workday, unless the manufacturer specifies more frequent intervals. Equipment calibration will occur more frequently as conditions dictate. APT field staff will examine field equipment periodically during field activities to verify that the equipment is in operating condition. The APT Project Manager or other APT staff will periodically audit the calibration and field performance of the field equipment to ensure that the system of field calibration meets the manufacturer's specifications.

Field instruments will include a portable organic vapor meter (OVM) equipped with a PID and a pH/conductivity/temperature meter. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

The OVM instrument will be calibrated in the field at the beginning and end of each day of sampling using a 100 parts per million by volume (ppmv) isobutylene calibration gas. Acceptable results of the OVM verification check should be plus or minus 10 percent of the true value of the calibration gas. The OVM instrument will be recalibrated if the result of the verification check is outside of acceptable limits and as necessary in response to any malfunction or anomalous behavior of the instrument. Equipment calibration will be performed to manufacturers' instructions. If equipment malfunction is suspected and calibration failure occurs, equipment will be removed from service and substitute equipment obtained. Documentation of field calibration of the OVM instrument will be recorded in the Field Logbook.

The pH/conductivity/temperature meter will be calibrated in the field at the beginning and end of each day of sampling. Re-calibration will be conducted as necessary in response to any instrument malfunction or anomalous behavior of the instrument. Equipment calibration will be performed according to manufacturer instructions. Documentation of field calibration of the pH, specific conductivity, and temperature meter will be recorded in the Field Logbook.

2.5.2 Laboratory Instrumentation

The proper calibration of laboratory equipment is a key element in the quality of the analysis done by the laboratory. Each type of instrumentation and each USEPA-approved method have specific requirements for the calibration procedures, depending on the analytes of interest and the medium of the sample.

Soil, groundwater, surface water, and sediment samples collected during the completion sampling and any supplemental subsurface investigations may be analyzed for one or all of the following: VOCs, SVOCs, PCBs, and metals in accordance with the applicable USEPA and IDEM protocols. The laboratory QA Manager will be responsible for assuring that the laboratory instrumentation is maintained in accordance with specifications. Individual laboratory SOPs will be followed for corrective actions and preventive maintenance frequencies.

2.6. DATA MANAGEMENT

The APT project Manager and the field personnel will manage data obtained in the field. Additional data management protocols are described in the SAP. The raw data obtained during field activities (i.e., measurements, boring logs, observations, etc.) will be recorded on the appropriate field forms or in individual field logbooks. This data will become part of the project files and be maintained as described in Section 1.6 of this QAPP.

APT will manage data derived from laboratory activities. Analytical data reports generated by the private laboratory will present all sample results, including all QA/QC samples. Processing of data by APT will be performed in accordance with APT's internal data management protocol and will be managed by the APT Project Manager. All laboratory internal QA/QC measures will be performed in accordance with the laboratory's SOPs.

3.0 ASSESSMENT OVERSIGHT

System and performance audits of field and laboratory activities will be performed to ensure compliance with the sampling and analytical directives of this QAPP. These audits may be internally or externally led, as described in the following sections.

3.1 TECHNICAL SYSTEMS AUDITS

Technical systems audits will have four components: field data, field screening instruments, report preparation, and laboratory data.

3.1.1 Field Data

An APT geologist will be present at the site during the sampling activities. This geologist will provide all on-site supervision required during the project. The geologist will be in daily contact with the APT Project Manager or designee, who will then review compliance with the project objectives and sampling protocol outlined in this QAPP. Any anticipated changes or modifications to sampling or measurement procedures will be reported to the City, the USEPA Project Manager, and the IDEM VRP Project Manager by the APT Project Manager. APT site personnel will document any modifications in the field log book.

Sampling data precision will be determined by the collection and subsequent analysis of sample duplicates, equipment blanks, trip blanks and bottle blanks to verify reproducibility (refer to **Table 2**).

3.1.2 Field Screening Instruments

The APT field geologist will audit and maintain the field screening instruments, such as the OVM. Instruments will be calibrated and maintained according to standard procedures.

3.1.3 Report Preparation

Prior to submittal to the USEPA, the IDEM, and the City, all reports will undergo a peer review conducted by a project team within APT. All components of the report will be checked and initialed by a designated team member.

3.1.4 Laboratory Data

Laboratory results will be reviewed for compliance against the DQO criteria for the level of reporting required.

3.2 PERFOMANCE EVALUATION AUDITS

Performance evaluation audits will have two components: field audits, and laboratory audits.

3.2.1 Field Audits

An APT geologist will be on site during all drilling and sampling events. This person will document sample collection activities, follow chain-of-custody protocol and prepare the samples for transport to the laboratory. Upon delivery, APT will verify with the laboratory that all sample numbers are correct, proper analytical requests are included, dates and times are correct, and the sampler's signature is recorded on the form. Personnel field books and instrument calibration records will also be reviewed periodically.

The APT project QA Officer will conduct the audits of field activities. In addition, USEPA or IDEM personnel may also perform a field audit at any time during the field activities. At least one field audit will be completed near the beginning of the sample collection activities under an investigation. If a second phase of field activities is necessary, and the second phase starts more than six months following the initial phase, then a second field audit will be completed. The field audit will include the following checklist:

Description of Field Audit Task	QA Officer Initials
Review of field sampling records	
Review of field measurement procedures	
Examination of the application of sample identifications following the specified protocol	
Review of field instrument calibration records and procedures	
Re-calibration of field instruments to verify calibration to the manufacturer's specifications	
Review of the sample handling and packaging procedures	
Review of chain-of-custody procedures	

If deficiencies are observed during the audit, the deficiency shall be noted in writing and a follow-up audit may be completed, if deemed necessary by the project QA Officer. Corrective action procedures may need to be implemented due to the findings from the audit. Such actions will be documented in the field log book.

3.2.2 Laboratory Audits

The laboratory QA Manager will be responsible for assuring that laboratory data precision and accuracy is maintained in accordance with specifications and laboratory SOPs.

3.3 REPORTS TO MANAGEMENT

For the duration of the project, periodic status reports will be prepared by the APT Project Manager or designee and submitted to the Project ReNEW Director. The Project Coordinator will in turn prepare periodic status reports that will be submitted to the USEPA on behalf of the City. These reports will serve to inform the City and the USEPA of the project's progress and any significant interim findings as they are identified. This will make it possible for issues to be addressed as they occur and redirect efforts to better define the environmental concerns. At the completion of the subsurface investigation, draft and final reports will be issued, as described in Section 1.6 of this QAPP.

4.0 DATA VALIDATION AND USABILITY

This section describes the QA activities that will be performed to ensure that the collected data are scientifically defensible, properly documented, of known quality, and meet project objectives. All analytical data collected for Project ReNEW will be validated.

Raw field data and laboratory data results will be reviewed for completeness, accuracy and quality. Data generated during field activities will be reviewed by the APT Project Manager at the completion of field activities. Organic Low Concentration data will be manually reviewed. Data generated during field activities will be computerized, if applicable, in a format organized to facilitate data review and evaluation.

Laboratory analytical data provided by the laboratory must be reported with the APT field sample number, and will be reviewed by the laboratory QA Manager, prior to delivery to APT. Computer generated tables will be utilized to compare laboratory results to published VRP Tier II Cleanup Criteria or default RISC closure criteria, as appropriate.

All data generated as part of the investigation will be reviewed by APT as part of draft and final report preparation activities. All data compilations in tables and figures will be subject to the APT QC checkprint process. All checkprints will be initialed and dated by the reviewer and sent to the project file. Narrative discussions of the data will be subject to APT's internal peer review process, with a peer review checklist signed off on by the author, peer reviewer, and management.

The following three steps will be followed to ensure that project data quality needs are met:

1. *Data Verification* – Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements. Data verification will be performed internally by the laboratory generating the data. Additionally, data may be checked by an entity external to the laboratory. Data verification may result in accepted, qualified, or rejected data.
2. *Data Validation* – Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set. Data validation criteria are based on the measurement performance criteria of the project QAPP. Data validation will be performed by the group that generates the data. Data validation results are accepted, qualified, or rejected data.
3. *Data Usability Assessment* – Data usability assessment is the process of evaluating validated data to determine if the data can be used for purpose of the project (*i.e.*, to answer the environmental questions or to make the environmental decision that must be made). Data usability will include the following sequence of evaluation:
    a) First, individual data sets will be evaluated to identify the measurement performance/usability issues/problems affecting the ultimate achievement of project DQOs.

b) Second, an overall evaluation of all data generated for the project will be performed.

c) Lastly, the project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

4.1 INSTRUCTIONS FOR DATA REVIEW, VALIDATION, AND VERIFICATION

This section describes the process for documenting the degree to which the collected data meet the project objectives, individually and collectively. APT will estimate the potential effect that each deviation from QAPP may have on the usability of associated data item, its contribution to the quality of reduced and analyzed data, and its effect on the decision.

The following procedures will be implemented to verify and validate data collected during the project:

- *Sampling Design* – How closely a measurement represents the actual environment at a given time and location is a complex issue. Each sample will be checked for compliance with the specifications, including type and location. APT will note deviations from the specifications, and discuss them with the USEPA Project Manager.
- *Sample Collection Procedures* – Sample collection procedures identified in the QAPP will be followed. If field conditions require deviations, they will be discussed with the USEPA Project Manager.
- *Sample Handling* – Deviations from the planned sample handling procedures will be noted on the COC forms and in the field notebooks. Data collection activities will indicate the events that occur during sample handling that may affect the integrity of the samples. APT field personnel will evaluate the sample containers and the preservation methods used and ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample (*e.g.*, proper labeling and COC records) will be made to ensure that the sample continues to be representative of its native environment as it moves through the analytical process.
- *Analytical Procedures* – Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified. Data validation activities will be used to determine how seriously a sample deviated beyond the acceptance limit so that the potential effects of the deviation can be evaluated.
- *Quality Control* – For each specified QC check, the procedures, acceptance criteria, and corrective action should be specified. The corrective actions that were taken, which samples were affected, and the potential effect of the actions on the validity of the data will be documented.

➢ *Calibration* – Field and laboratory instruments calibrations will be documented to ensure that calibrations:

- Were performed within an acceptance time prior to generation of measurement data;
- Were performed in proper sequence;
- Included the proper number of calibration points;
- Were performed using a standard that "bracketed" the range of reported measurement results; and
- Had acceptable linearity checks and other checks to ensure that the measurement system was stable when calibration was performed.

When calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration will be flagged to alert data users.

➢ *Data Reduction and Processing* – Checks on data integrity will be performed to evaluate the accuracy of raw data and include the comparison of important events and duplicate re-keying of data to identify data entry errors.

4.2 INSTRUCTIONS FOR VALIDATION AND VERIFICATION METHODS

This section describes the process that will be followed to verify and validate the project data.

4.2.1 Verification

The APT QA Officer will verify sample collection, handling, and field screening procedures as described in this QAPP and the VRP RWP. Laboratory data will be verified with respect to the COC, units of measure, and citation of analytical methods. The QA Officer will also verify the use of the blanks and duplicates. All applicable reference and identification codes and numbers will be reviewed as part of the documentation. A checklist of these items will be prepared and will bear the QA Officer's name and the review date.

4.2.2 Validation

All sampling, handling, field analytical data, and fixed laboratory data will be validated by entities external to the data generator. The validation procedure will specify the verification process of every quality control measure used in the field and laboratory. Each analytical report will be reviewed for compliance with the applicable method and for the quality of the data reported.

4.3 INSTRUCTIONS FOR RECONCILIATION WITH DQOs

This section describes the scientific and statistical procedures/methods that will be used to determine whether data are the right type, quality, and quantity to support environmental decision making for the project.

The data quality assessment (DQA) process is described in "Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis", EPA QA/G-9, July 1996. The DQA process will consist of five steps:

1. Review DQOs and sampling design.
2. Conduct preliminary data review.
3. Select statistical test.
4. Verify assumptions.
5. Draw conclusions from the data.

While the formal DQA process presented in this QAPP may not be followed in its entirety, a systematic assessment of the data quality will be performed. This process will include a preliminary data review. Data will be presented in tables and figures to identify the trends, relationships, and anomalies.

4.3.1 Precision

In order to meet the needs of the project, project data must meet the measurement performance criteria for precision. The methods outlined in Section 1.5.1 of this QAPP will be implemented to ensure that the data is precise.

Poor overall precision may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, and/or heterogeneous matrices. In order to identify the cause of imprecision, the field sampling design rationale and sampling techniques should be evaluated, as well as field and laboratory duplicate/replicate sample results. If poor precision is indicated in both the field and analytical duplicate/replicate sample results, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate sample results, then the sampling technique, field instrument variation, sample transport, and/or heterogeneous sample matrices may be the source of error.

If the data validation assessment indicates that the analytical imprecision exists for a particular data set, then the impact of that imprecision on data usability must be discussed in the *VRP Completion Report*.

When project-required precision is not achieved and project data are not usable to adequately address environmental questions (*e.g.*, determining if regulatory or technical action limits have been exceeded) and decision making, then the data assessment sections of the *VRP Completion Report* should address how this problem will be resolved and discuss the need for re-sampling.

4.3.2 Accuracy/Bias

In order to meet the needs of the data users, project data will follow the measurement performance criteria for accuracy/bias specified in Section 1.5.2 of this QAPP.

QC check sample data will be reviewed to evaluate the accuracy and potential bias of sample results. If field contamination exists, then the impact of field contamination on data usability will be discussed in the *VRP Completion Report*. Contamination associated with field sample collection and transport (*i.e.*, equipment rinsate and trip blanks) should be differentiated from contamination introduced at the time of sample preparation and analysis at the laboratory (*i.e.*, contaminated method storage, or analytical instrument blanks). Note that sample contamination may result in either negative or positive bias. For example, improperly cleaned sample containers for metals analysis may result in the retention of metals from the sampled media on interior container walls, which would result in a lower metals concentration being reported than are actually present in the sample (*i.e.*, negative bias). Alternatively, residual contaminants on sampling or analytical equipment may result in contamination of the sampled media, resulting in a reported analyte concentration that is higher than the true concentration of that analyte in the sample (*i.e.*, positive bias).

If the data validation assessment indicates that analytical inaccuracies or bias exists for a particular data set(s), then the impact of that inaccuracy or bias will be discussed in the *VRP Completion Report* on a matrix-by-matrix basis. This discussion will include identification of qualitative and quantitative bias trends, the impact of any trends on the sample data, and the limitations on the use of the data set(s) in question resulting from any identified bias.

When project-required accuracy bias is not achieved and project data are not usable to adequately address environmental questions (*e.g.*, determining if regulatory or technical action limits have been exceeded) and decision making, then the data assessment sections in the *VRP Completion Report* should address how this problem will be resolved and discuss the need for re-sampling.

4.3.3 Sample Representativeness

In order to meet the needs of the data users, project data must meet the measurement performance criteria for sample representativeness specified in Section 1.5.3 of this QAPP.

QC check and sample data will be reviewed to assess sample representativeness. While there is no quantitative measure of representativeness, sample data can be evaluated qualitatively with regard to spatial variations in site conditions (*e.g.*, heterogeneity in subsurface characteristics).

The data assessment sections of the *VRP Completion Report* will discuss and compare overall representativeness for each matrix, parameter, and concentration. This report will describe the limitations on the use of project data when overall non-representative sampling has occurred or when non-representative sampling is limited to a specific sampling group, data set, matrix, analytical parameter, or concentration. If data are not usable to adequately address environmental questions and/or support project decisions, then the data assessment sections of the *VRP Completion Report* will address how this problem will be resolved and discuss the potential need for re-sampling.

4.3.4 Sensitivity and Quantitation Limits

In order to meet the needs of the data user, project data must meet the measurement performance criteria for sensitivity specified. Low point calibration standards should produce a signal at least ten times the background noise level and should be part of a linear calibration curve.

If the data quality assessment indicates that sensitivity and/or quantitation limits (QLs) were not achieved, then the impact of that lack of sensitivity and/or higher QLs on data usability will be discussed in the *VRP Completion Report*. The data assessment sections of these reports will discuss and compare overall sensitivity and QLs from multiple data sets collected for the project for each matrix, analytical parameter, and concentration. This discussion will also describe the limitations on the use of the project data if project-required sensitivity and QLs were not achieved for all project data or when it is limited to a specific sampling or laboratory/analytical group, data set, matrix, analytical parameter, or concentration.

When project-required QLs are not achieved and project data are not usable to adequately address environmental questions (*e.g.*, determining if regulatory or technical action limits have been exceeded) and decision making, then the data assessment sections of the *VRP Completion Report* should address how this problem will be resolved and discuss the need for re-sampling.

4.3.5 Completeness

In order to meet the needs of the data users, project data must meet the measurement performance criteria for sample completeness specified in Section 1.5.4 of this QAPP.

The *VRP Completion Report* will discuss and compare overall completeness of data for each matrix, parameter, and concentration. This discussion will describe the limitations on the use of project data if project-required completeness was not achieved for the overall project or when it is limited to a specific sampling group, data set, matrix, analytical parameter, or concentration.

If project-required completeness is not achieved and sufficient data are not available to adequately address environmental questions and/or support project decisions, then the data assessment sections of the *VRP Completion Report* will address how this problem will be resolved and discuss the potential need for re-sampling.

4.3.6 Comparability

In order to meet the needs of the data users, project data must meet the measurement performance criteria for sample comparability specified in Section 1.5.5 of this QAPP.

For long-term monitoring projects, data comparability is critical. Project data will be compared to previously generated data to determine the possibility of false positives and/or false negatives. Variation detected in the data may reflect a changing environment or indicate sampling or analytical error. Comparability criteria will be established to evaluate these data sets in order to identify outliers to trigger re-sampling as necessary.

The *VRP Completion Report* will discuss and compare overall comparability between multiple data sets collected for the project for each matrix, parameter, and concentration. This discussion will describe the limitations on the use of project data if project-required comparability was not achieved for the overall project or when it is limited to a specific sampling group, data set, matrix, analytical parameter, or concentration.

If project-required comparability criteria are not met for investigative, completion, or IDEM split sampling (including long-term monitoring), then this will be documented in the data assessment sections of the *VRP Completion Report*, and the effect on data usability will be discussed. This assessment will also include a discussion whether non-conformable data indicate a changing environment or if the anomalies are a result of sampling or analytical error

If data are not usable for adequately addressing environmental questions or supporting project decisions, then the data assessment sections of the *VRP Completion Report* will address how this problem will be resolved and discuss the potential need for re-sampling.

4.3.7 Data Limitations and Actions

Sources of sampling and analytical error will be identified and corrected as early as possible to the onset of sample collection activities. An ongoing data assessment process will be incorporated during the project, rather than just as a final step, to facilitate the early detection and correction of problems. This process will help ensure that project quality objectives are met.

TABLES

TABLE 1
QA OBJECTIVES FOR FIELD MEASURMENTS
Quality Assurance Project Plan
Former Karwick Road Landfill
Michigan City, Indiana

Parameter	Method[1] Reference	Precision[2]	Accuracy[3]	Completeness
WATER				
Standing Water Levels	Solinist Water Level Indicator	+/-0 01 ft	0 005 ft	90%
Temperature	E170., Mercury Thermometer or Electronic Temperature Probe	+/-0 5°C	1.0°C	90%
Conductivity	E120.1, Electrometric	+/-25	10 umho/cm^2	90%
pH	E150 1, Electrometric	+/-0.1 pH units	0.05 pH units	90%

Notes:

1 Methods: E - Method for Chemical Analysis for Water and Wastes (U.S. EPA. September 1983)
SW - Test for the Evaluation of Solid Waste, SW-846, U.S. EPA, September 1986
SM Standard Methods for Examination of the Water and Wastewater, 18th ed (APHA, 1992)
ASTM - Annual Book of ASTM Standards, American Society of Testing and Materials 1995.

2 Expressed as the acceptable deviation from the Scale.

3 Expected based on equipment manufacturer specifications

TABLE 2
QA/QC SAMPLE REQUIREMENTS
Quality Assurance Project Plan
Former Karwick Road Landfill
Michigan City, Indiana

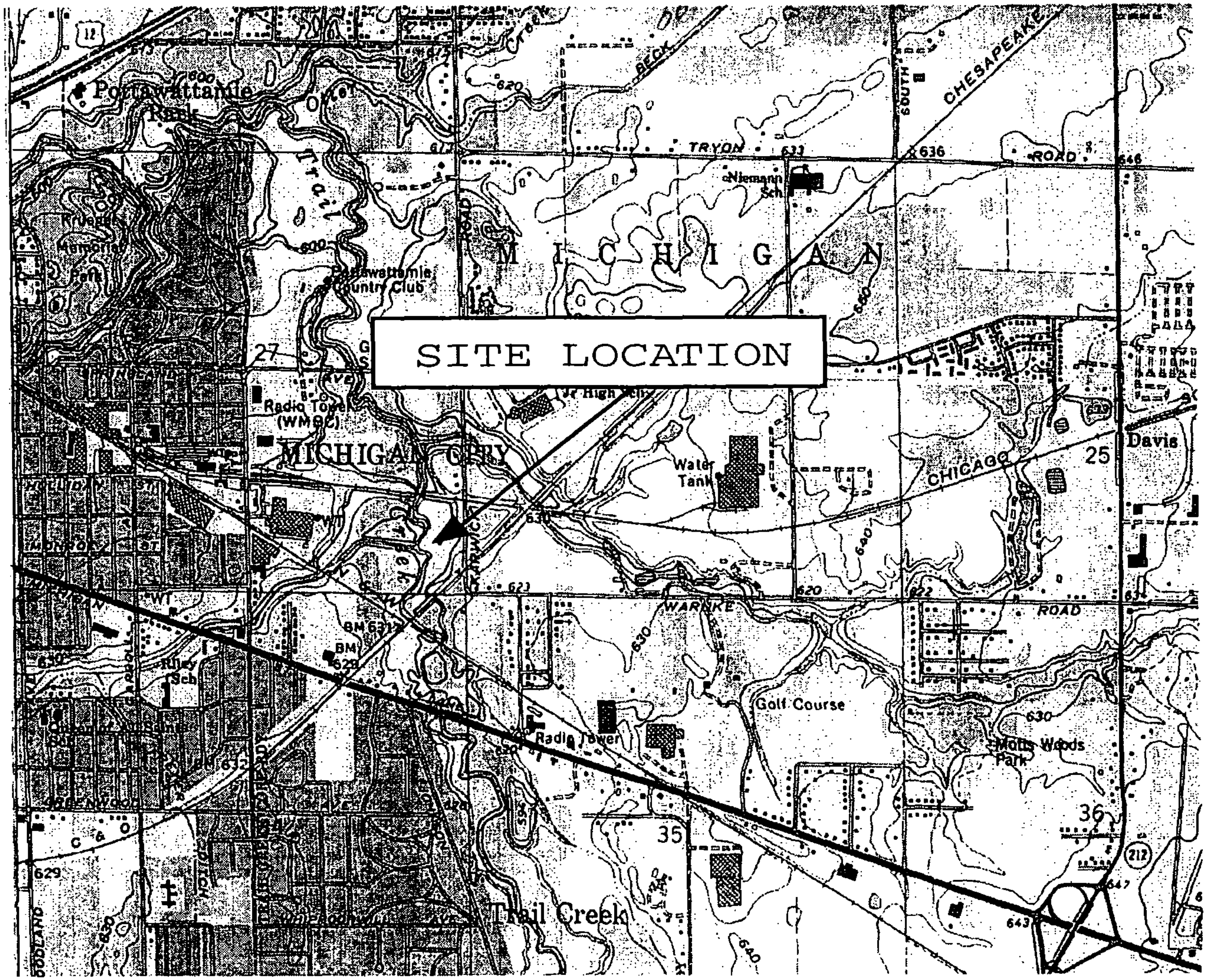
QC Sample Type	Frequency of Sample Analysis	Details
Field Samples		
Equipment Rinsate Blanks	1 per 10 investigative samples per site (per sample matrix) (minimum 1 per day of sampling)	Distilled water placed into contact with sampling equipment. Used to assess quality of data from field sampling and documentaion procedures.
Trip Blanks	1 per sample cooler/VOC analysis	Laboratory-prepared, organic-free blank to assess potential contamination during sample container shipment and storage.
Duplicate Samples	1 per 10 investigative samples per site (per sample matrix) (minimum 1 per round of sampling)	Duplicate sample collected by the same methods and at the same time as original sample. Used to verify sample and analytical reproducibility.
Laboratory Samples		
Matrix Spike/ Matrix Spilke Duplicate	1 per 20 investigative samples per site (per sample matrix)	Laboratory spiked sample to evaluate matrix and measurement methodology.
Method Blanks	1 per daily run and as needed	Laboratory blank sample to assess potential contamination form laboratory instruments/procedures.
Laboratory Control and Duplicates	Analyzed as per method requirements and laboratory SOPs	Evaluates laboratory reproducibility.
Sample Container Samples	1 per organic sample container lot, at a minimum	Performed by container distributor, ensures that sample containers are contaminant free.

TABLE 3
SAMPLE BOTTLES, METHODS, PRESERVATIVES, AND HOLD TIMES
Quality Assurance Project Plan
Former Karwick Road Landfill
Michigan City, Indiana

Sample Name[1]	Sample Matrix	Number of Samples	Sample Type	Containers & Preservative	Analytical Parameters[2]	Hold Times	Analytical Methods
SB-#;*[depth]*	Soil	40 surface; 40 subsurface	Completion	1, 4 oz Jar Non-preserved (30 g) (4° C)	VOCs	7-days (Non-Preserved & frozen upon receipt by lab) 3 days (Non-Preserved, 4° C)	SW-846 Method 8260
				1, 4 oz Jar Non-preserved (30 g) (4° C)	SVOCs	14 days Extract, 40 days Analysis	SW-846 Method 8270
				1, 4 oz Jar Non-preserved (10 g) (4° C)	PPL Metals	6 months (24 hr Cr6, 28 days Hg)	SW-846 Methods 6010/7471
MW-#;*[date]*	Groundwater	32 VOCS; 32 SVOCs; 4 MSD	Completion Spike Duplicate	3, 40-mL Vials (HCl < pH 2, 4° C)	VOCs	14 days	SW-846 Method 8260
				2, 1-L Amber (Non-Preserved, 4° C)	SVOCs	7 days Extract,	SW-846 Method 8270
				1, 500-mL Bottle (HNO_3, 4° C)	SVOCs	7 days Extract, 40 days Analysis	SW-846 Method 8270
MS/MSD SD-#;*[depth]*	Sediment	1 MS; 1 MSD	Matrix Spike/Matrix Spike Duplicate	1, 4 oz Jar Non-preserved (30 g) (4° C)	SVOCs	14 days Extract, 40 days Analysis	SW-846 Method 8270
				1, 4 oz Jar Non-preserved (10 g) (4° C)	PPL Metals	6 months (24 hr Cr6, 28 days Hg)	SW-846 Methods 6010/7471
				1, 4 oz Jar Non-preserved (30 g) (4° C)	PCBs	14 days Extract, 40 days Analysis	SW-846 Method 8082
ER-#;*[date]*	Aqueous	16 (Estimate) One per day of sampling	Equipment Rinsate Sample	3, 40-mL Vials (HCl < pH 2, 4° C)	VOCs	14 days	SW-846 Method 8260
				2, 1-L Amber (Non-Preserved, 4° C)	SVOCs	7 days Extract, 40 days Analysis	SW-846 Method 8270
				1, 500-mL Bottle (HNO_3, 4° C)	PPL Metals	6 months (24 hr Cr6, 28 days Hg)	SW-846 Methods 6010/7471

Notes:
1. The soil samples to be collected by APT from soil borings advanced by Top Flight Environmental Drilling Services.
2. Samples to be analyzed by Pace Analytical of Indianapolis, Indiana for volatile organic compounds (VOCs), semivolitile organic compounds (SVOCs), priority pollutant list (PPL) metals, and poylchlorinated biphenyls (PCBs) using the stated analytical method.

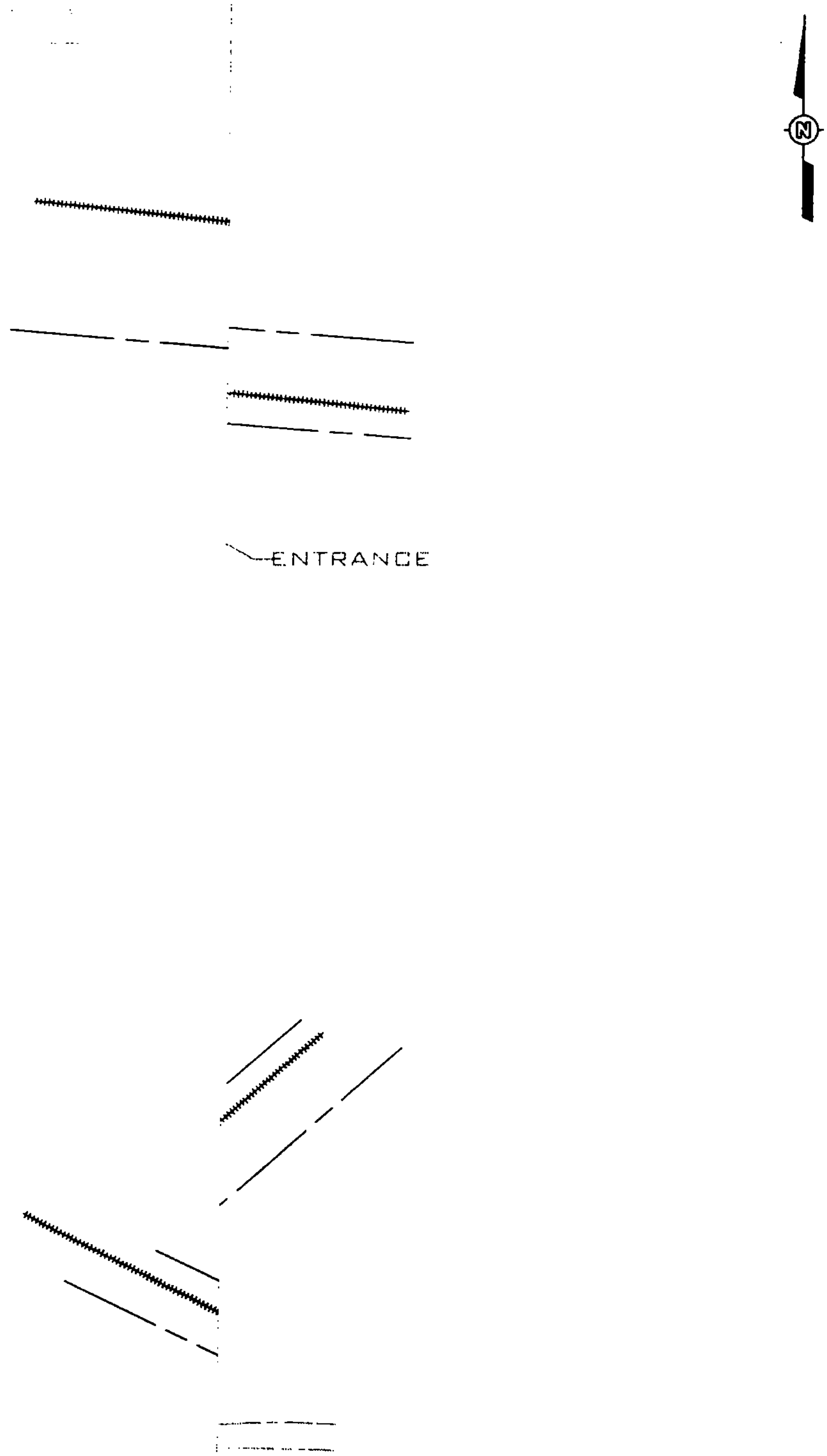
FIGURES



SCALE 0 1000 2000 FEET

USGS QUAD MICHIGAN CITY EAST, IN 7.5 MINUTE 1969 (REV. 1980)

APT	PROPERTY OF APT THIS DOCUMENT WAS PRODUCED BY APT AS AN INSTRUMENT OF SERVICE AND REMAINS THE PROPERTY OF APT. THIS DOCUMENT IS CONFIDENTIAL AND MAY NOT BE REUSED OR MODIFIED FOR MORE THAN THE CLIENT'S INTERNAL USE WITHOUT THE PRIOR WRITTEN AUTHORIZATION OF APT. ALL RIGHTS OF DESIGN ARE RESERVED.	TASK: 1	M. C. PARKS & RECREATION MICHIGAN CITY, IN	FIGURE 1
		DWG: 312.1.F1.SL		
		DATE: 9-12-02	PREPARED FOR M. C. PARKS & RECREATION MICHIGAN CITY, IN	SITE LOCATION MAP
		DWG BY: AB		



ING WELL LOCATION

RING LOCATION

: WATER AND SEDIMENT SAMPLING LOCATION

UND SURFACE WATER AND SEDIMENT SAMPLING LOCATION

REFERENCE: SOURCE DRAWING FROM GEOTECHNICAL EXPLORATION REPORT

SCALE

0 100 200 FEET

SK B	KARWICK ROAD SITE MICHIGAN CITY, IN	FIGURE 2
G: 312.1.F2.MWSB		
TE: 12-31-03	PREPARED FOR MICHIGAN CITY PARKS & RECREATION MICHIGAN CITY, INDIANA	SITE MAP
G BY: AB		